THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXIV. No. 1890.] LONDON, AUGUST 1, 1899. [51ST YEAR. PRICE 6d.

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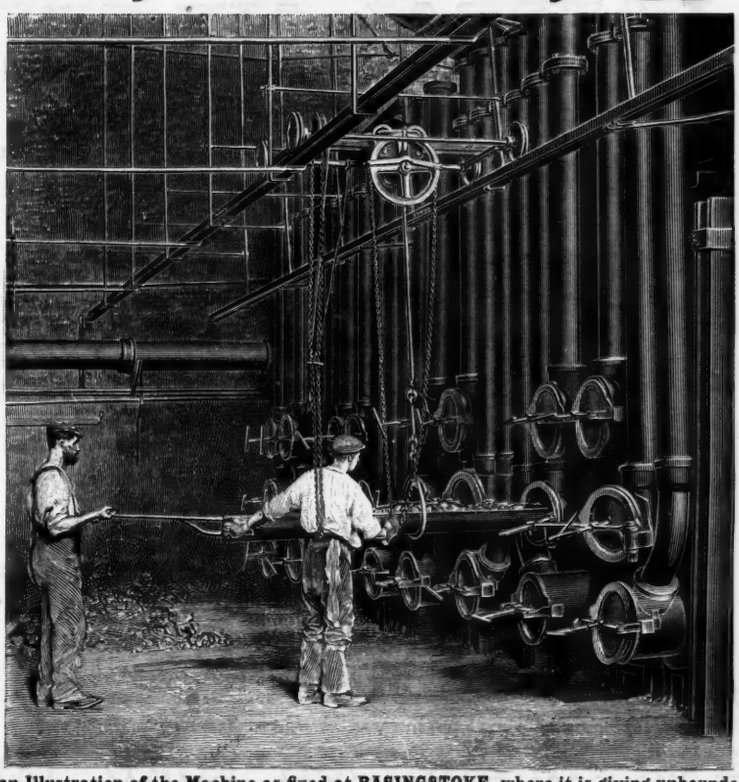

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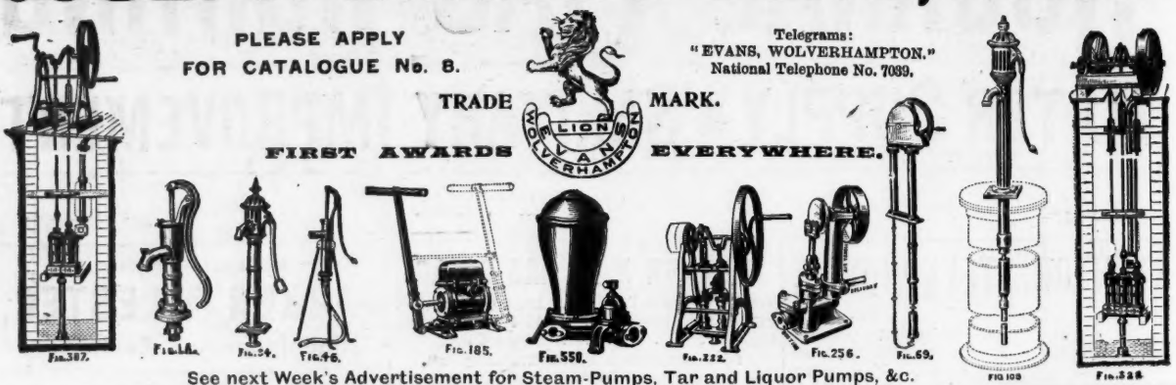

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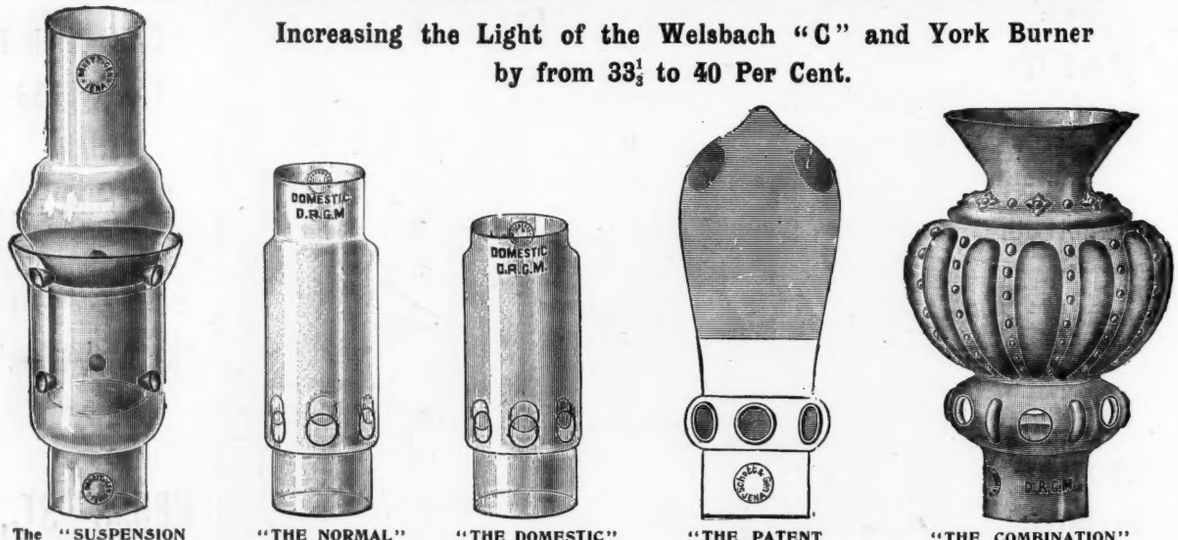

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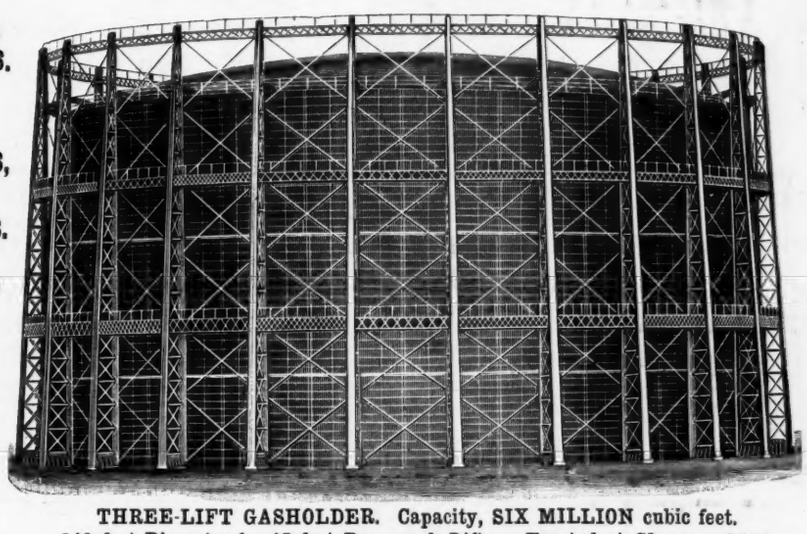

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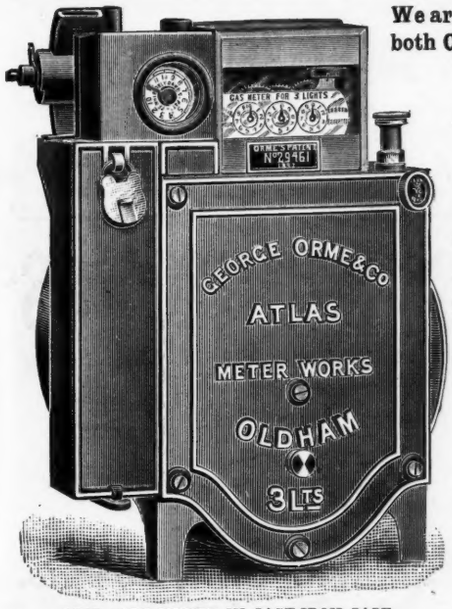

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A large number of these Meters are in use, and giving satisfaction.

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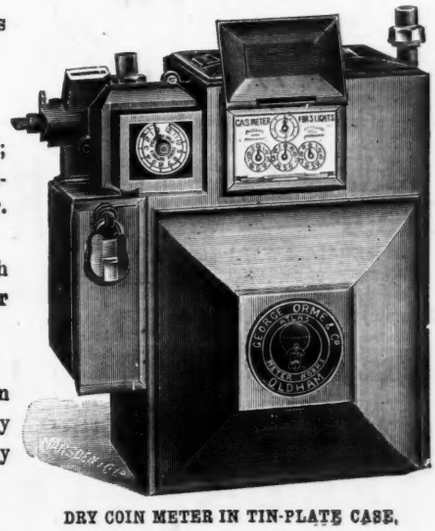

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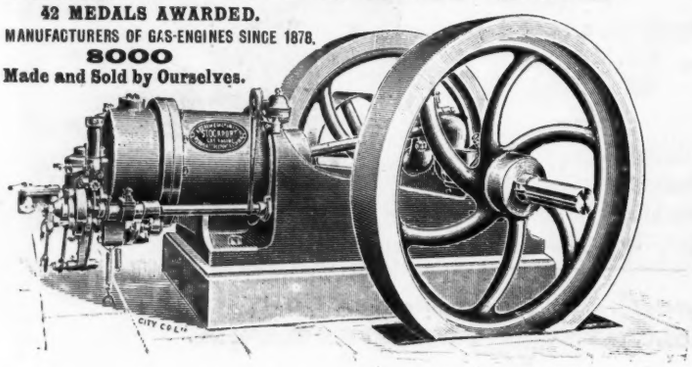

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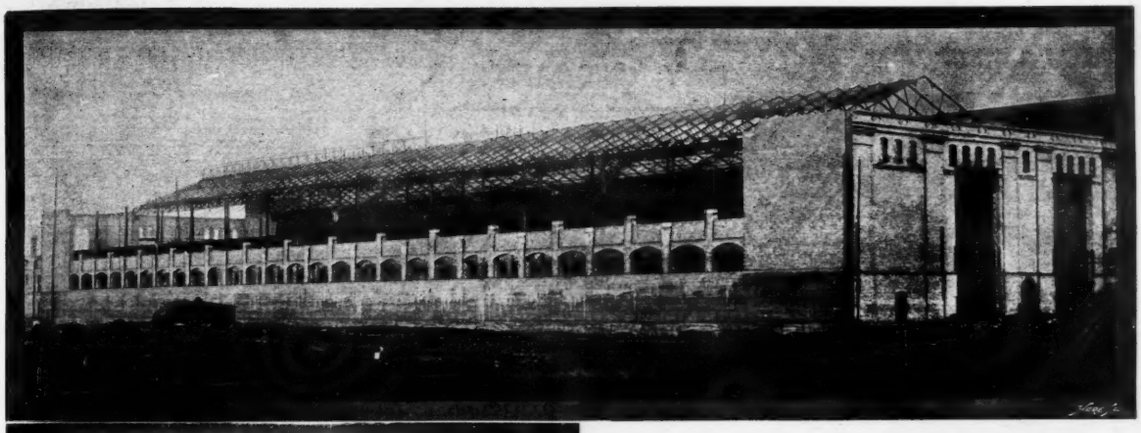

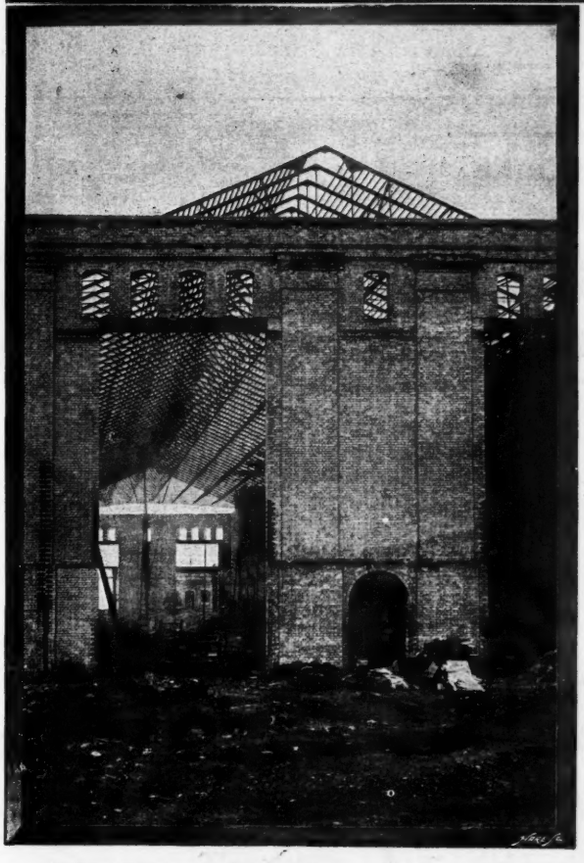

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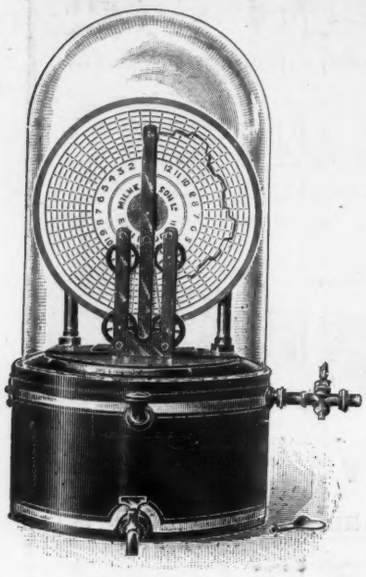

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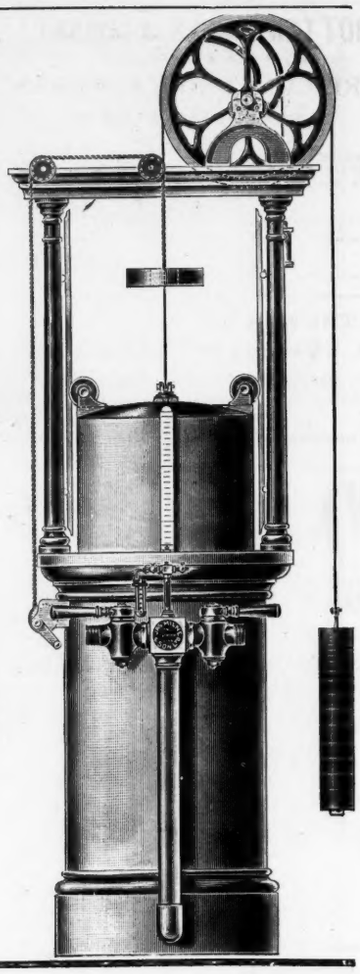

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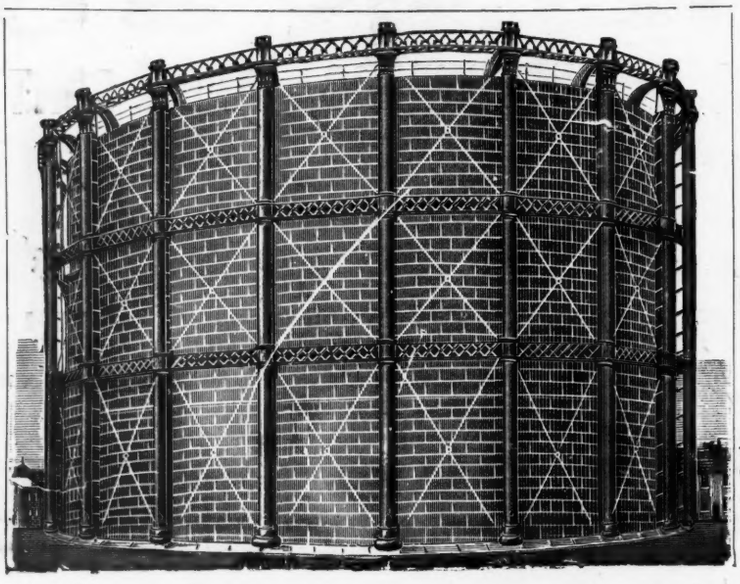

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Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

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Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

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GREAT SAVING IN TIME, PAINT, AND LABOUR.

Painting Speed—3 Square Yards a Minute. Lime-Wash Speed—12 Square Yards a Minute.

Paint Machine, attached to a Single Air-Compressor, Driven by Belt Power. Can also be driven from existing Air-Mains.

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Vertical Steam-Engine and Air-Compressor combined with Boiler on Wheel Base.

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HORIZONTAL TYPE.

Machines of this and Vertical Type erected last year and now on order, equal to 51,720,000 cubic feet per diem.

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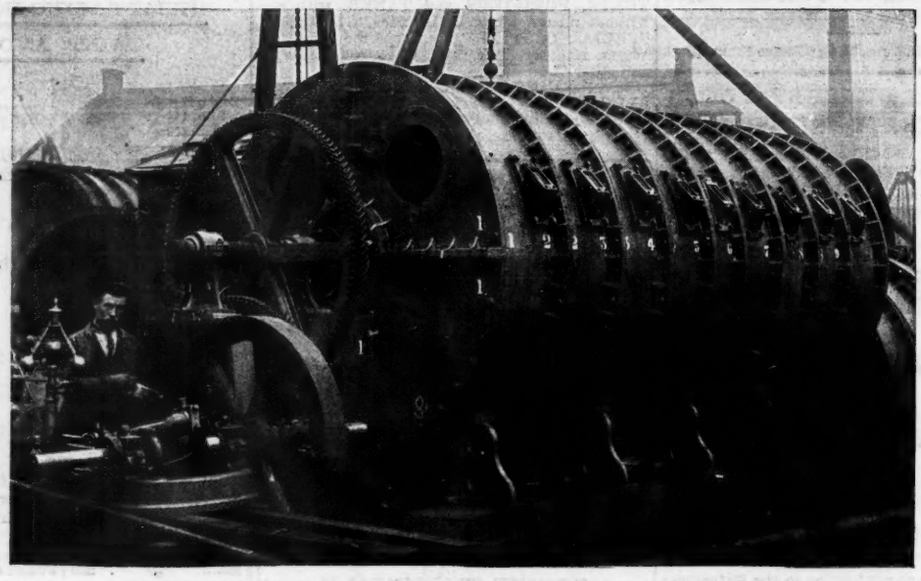

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25 Candles per Cubic Foot of Gas.

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The New Welsbach Burner is supplied in SIX Sizes, consuming from ¾ to 7 Cubic Feet of Gas per Hour.

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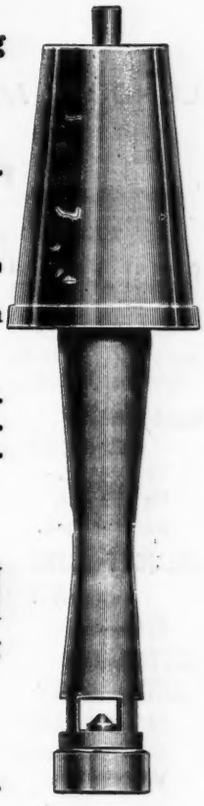

100 CANDLE POWER WITH 4 CUBIC FEET OF GAS.

To obtain a light of 100 Candles for 4000 hours with Gas at 2s. 3d. per 1000 Cubic Feet would cost—

With an Ordinary Gas-Burner	£18 0s.
With a new Welsbach Burner	£1 16s.
With an Incandescent Electric Lamp, at 5d. per unit	£30 0s.

THE

New Welsbach Anti-Vibration Attachment

Enables the New Welsbach Burner to be used for Street Lighting or otherwise, notwithstanding the severest vibration.

Made of Metal throughout.

Simple, Durable, Inexpensive.

Does not obstruct the Light.

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THE NEW METHOD OF PRODUCING A HIGH CANDLE-POWER LIGHT.

Especially recommended for use in Workshops, Railway Yards, and Open Spaces, where a high-power light from one centre is desired.

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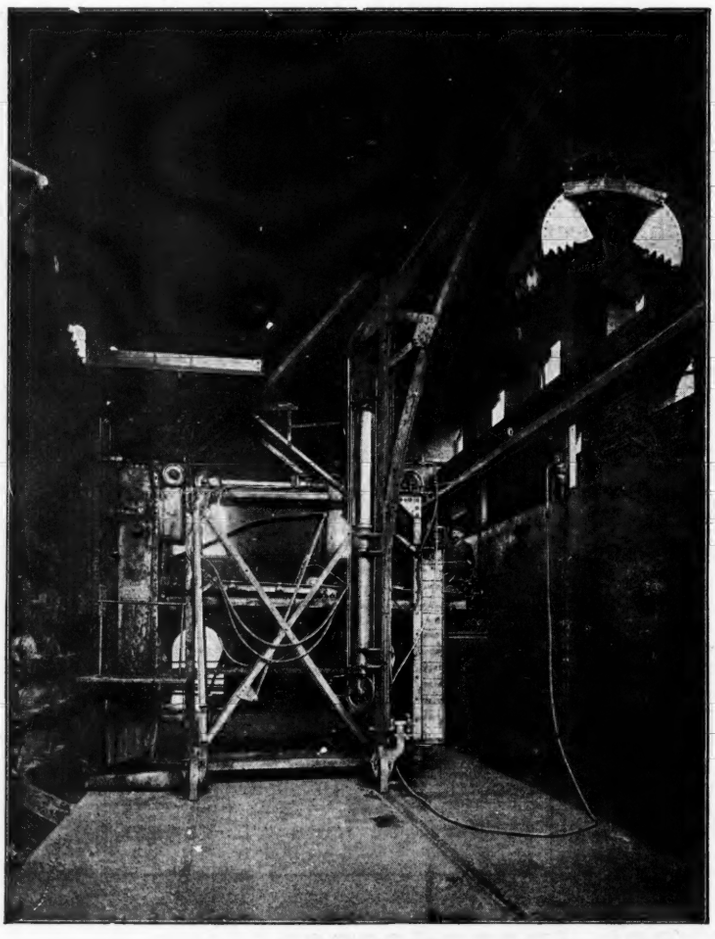

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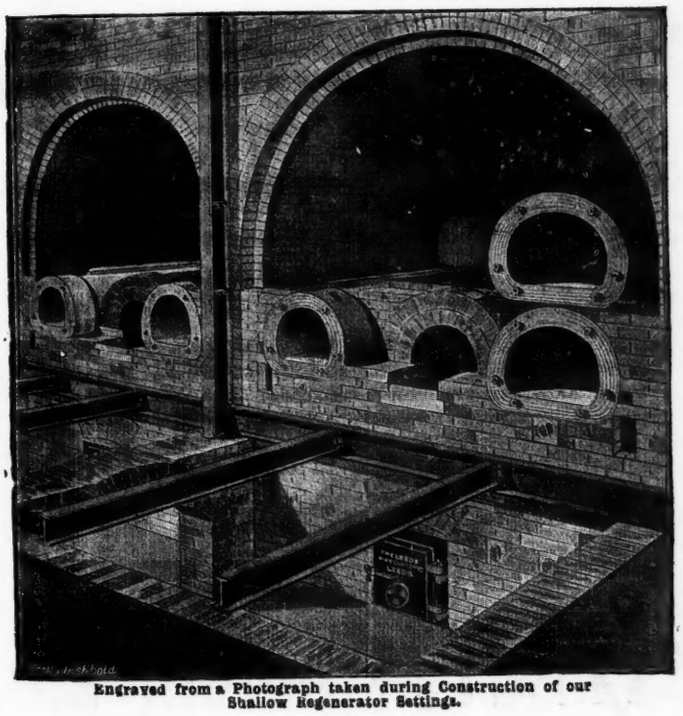

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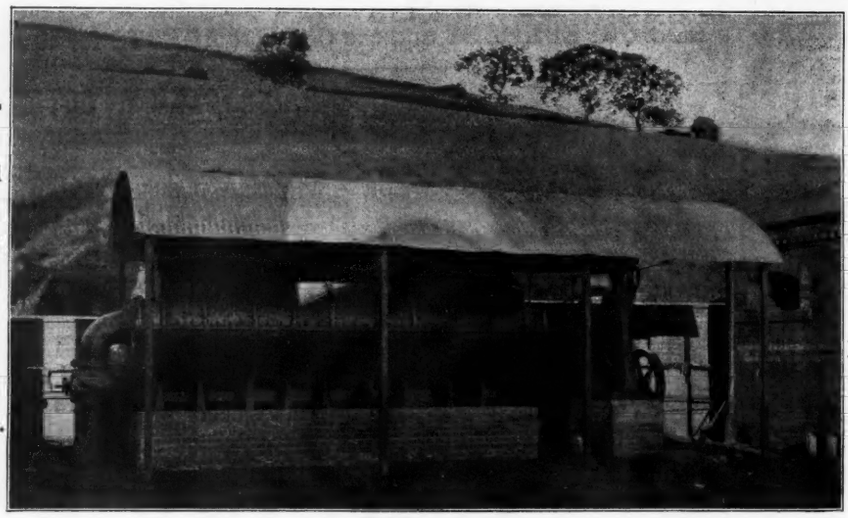

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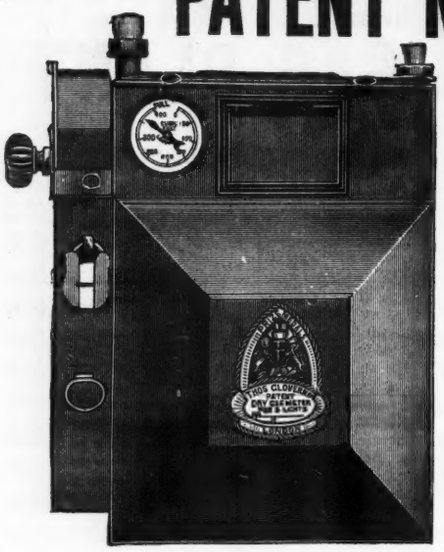

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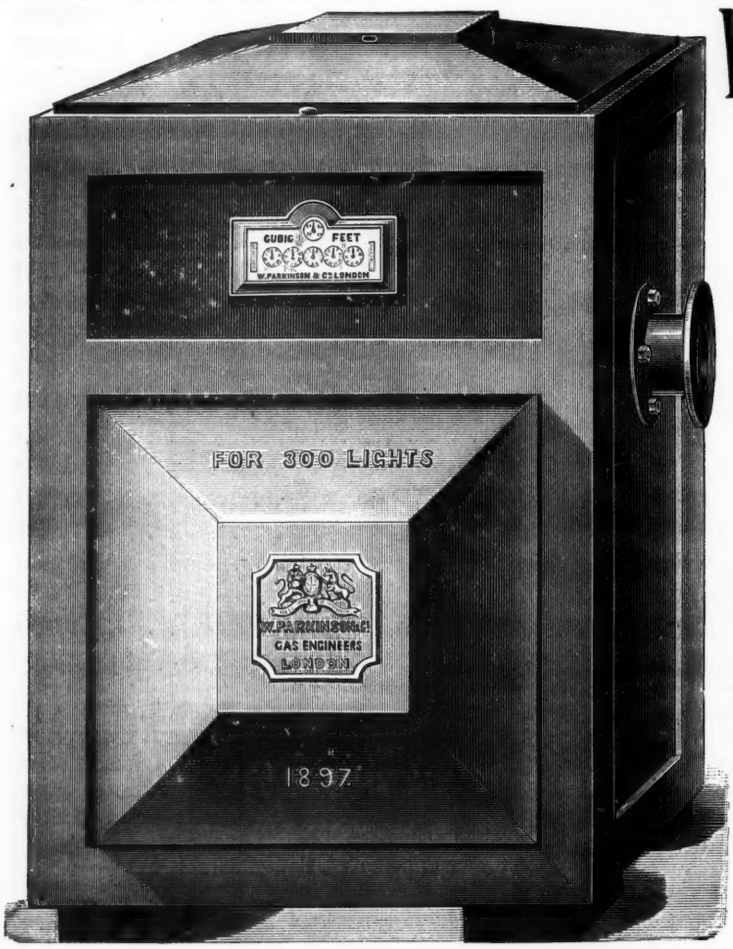

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EDITORIAL NOTES.

The Report of the London Gas Companies (Powers of Charge) Committee.

THE report of the Select Committee on Metropolitan Gas Companies (Powers of Charge) was issued last Thursday. The text of the document will be found in another column. To summarize the findings of the Committee as briefly as is possible, they amount to a verdict that the excessively high prices charged for gas by The Gaslight and Coke Company are not justified by the Company's circumstances, past or present, but are the direct consequence of over-capitalization, and want of "due care and management" in the administration of the affairs of the Company. While leaving the responsibility for the management of the Company's business where it properly belongs, the Committee indicate several ways in which parliamentary action might operate to repair past mischief, as well as improve the Metropolitan gas settlement for the future. The Committee do not favour any revolutionary project for transferring the gas supply of London to a Public Authority, re-establishing competition between the Companies, further amalgamations, or indeed for any radical alteration of the generally accepted principles of gas legislation. On the contrary, they approve of the sliding-scale and auction clauses as constituting an excellent arrangement for all parties, which should be maintained. They qualify this general approval, however, by raising the question of intention. The report says that "the intention of the sliding-scale was to give to "the consumers a special interest in economical adminis-"tration, while the control was left exclusively in the hands "of the Company. Hence there was an implied obligation "on the part of the Company that their affairs should be "administered (to quote the language of Mr. Cardwell's "Committee) 'with due care and management.' Your "Committee have arrived at the conclusion that this has "not been done. Hence, the intention of the parlia-"mentary bargain, which was in effect made, has not been "realized by the Company." If this view is maintained, it follows that Parliament is free to make another arrangement better calculated to realize the original design.

This leads up to the most important question of what Parliament should do in the circumstances—presuming that the sliding-scale and auction clauses are not to be abrogated. The Committee conclude that the standard price for London is too high for the principle to have its intended effect. It is therefore recommended that when a Metropolitan Gas Company comes to Parliament for more money, the standard price should be revised by reducing it to 3s. 3d. In order to effect this alteration beneficially, to "stimulate those Companies which had not succeeded in "bringing their prices to a low level to greater endeavours "to that end," without interfering with "those Companies "which had already attained low prices," the remarkable expedient of a "secondary sliding-scale" has been approved by the Committee. This secondary or additional scale is to permit of an increase or decrease of dividend, over and above that regulated by the present scale, of ¼ per cent. for every complete 3d. of decrease or increase below or above the standard price of 3s. 3d. It is necessary to see what this means in the actual circumstances of the first Company to go to Parliament, which is The Gaslight and Coke Company, whose Bill of this session was thrown out lest it should nullify the findings of the Committee. At present, with a standard price of 3s. 9d. and a selling price of 3s., this Company can divide $10 + \frac{2}{4} = 12\frac{1}{2}$ per cent.; and they do it. With the alteration now suggested, the statutory rate would be $10 + \frac{3}{4} + \frac{1}{4} = 11$ per cent. In the case of the Commercial Company, with the same initial price and selling gas at 2s. 6d., the statutory rate of dividend is $10 + \frac{1.5}{4} = 13\frac{3}{4}$ per cent.; but the Directors keep ¼ per cent. of this in hand—paying only 13½ per cent. Under the altered conditions, their statutory rate would be $10 + \frac{2}{4} + \frac{3}{4} = 13$ per cent. The South Metropolitan statutory rate, with their 3s. 6d. standard price, and selling at 2s. 2d. (actually, 1d. lower since Midsummer) is $10 + \frac{1.6}{4} = 14$ per cent.; but the Directors do not pay the whole of it—usually keeping back ¼ per cent. and a fractional balance. On the new basis, the dividend would be $10 + \frac{1.3}{4} + \frac{4}{4} = 14\frac{1}{4}$ per cent.; a gain of ¼ per cent. by way of recompense. This would make amends for anything that was oppressive in the fixing of the South Metropolitan standard price at 3d. under that of the two other London Companies in 1876.

Without pausing to discuss the merits of this ingenious modification of the sliding-scale, we will pass to the other recommendations of the Committee. These comprise the transfer to the South Metropolitan Company of the trans-pontine district of The Gaslight and Coke Company, with or without the Nine Elms works. The Committee consider that The Gaslight and Coke Company supply this district at a loss of about £10,000 a year, which might be saved, for the benefit of the northern consumers, by the severance. On the other hand, the Committee do not appear to have taken cognizance of the prospect that the annulment of the requirement to supply a district of private consumers at the current South Metropolitan price would operate to free The Gaslight and Coke Company from the consequential obligation to supply gas for public lighting over the whole of their district at the same price. The valuation of the severed area, as part of an undertaking, would be a nice exercise under the conditions; while the determination of the price to be paid for a works admitted to be only workable for the supply of its own vicinity at a loss would be a curious problem.

On the subject of the charge for prepayment supplies, the practice of the Gaslight Company has been to levy one rate on the North and another on the South of the Thames, which strikes the Committee as being unfair to the southern consumers. Having regard to the novel and extensive character of this branch of Gas Companies' business, the Committee consider that the special rates charged by all the London Companies require regulation. This is a very prudent and safe recommendation. Next, the Committee think that capital powers for a period of five years are as much as any Gas Company ought to have; and, further, "that Parliament should revise the sliding-scale, either by "way of increase or decrease, when any application for "new capital is made, if the circumstances of the times "or the conditions of the Company appear to require it." These are weighty and far-reaching suggestions. The idea that Gas Companies should not remain away from Parliament too long is sound, and justified by experience. It is clearly better that a Gas Company's finances should be brought up-to-date at reasonably frequent intervals than that they and their public should be condemned to bear for a whole generation the burden of what may have been a mistaken compromise. As to the proposal that the sliding-scale should be subject to revision at the same time, it is the first formal and general parliamentary pronouncement in this sense. There is only one precedent (and that a limited one) for it; but the signs of the times are in favour of the more elastic plan. The last definite recommendation of the Committee, that an effort should be made by Gas Companies having obsolete or unproductive capital to redeem it "by sinking fund or otherwise," opens up a very large prospect. Our readers may remember that we endeavoured to arouse interest in this question some years ago; but, in the absence of a case in point, the matter soon dropped.

So much for the general bearings of the report, and the specific recommendations of the Committee with regard to future gas legislation. The most acute curiosity, in professional circles, will be felt with regard to the manner in which the Committee express themselves concerning the administration of The Gaslight and Coke Company. For the inquiry of the Committee was—in essence, if not in form—a trial of the Horseferry Road oligarchy, represented actually by the Governor (Colonel Makins) and the Secretary and General Manager (Mr. John W. Field) on the charge of overtaxing the gas consumers of the Company's northern district by an amount of £800,000 a year, to pay for their own incapacity and that of their predecessors in office. Both these arraigned representatives of a system declined to admit that the public had any real cause for complaint, or that anything could possibly be better than the conduct of the undertaking in their hands. Colonel Makins assumed, in the face of criticism, the attitude of the traditional odd man on the jury, who thought his eleven colleagues the most stubborn and unreasonable men he had ever met. Mr. Field piled heaps upon heaps of figures to show that the alleged excessive charge for gas by The Gaslight and Coke Company is referable to certain data. The Committee have heard the defence. They marshal the indictment and the explanation in a remarkably lucid style, and declare themselves to be "of opinion that the "affairs of the Company have not been well managed."

Of course, Colonel Makins may affect to "pooh-pooh" this judgment as unworthy of respect. He cannot aver that it is a product of irresponsible critics, or of persons inspired by rancour. The Company must go to Parliament next year; and Parliament has a way of upholding its Committees. As Mr. A. J. Balfour remarked last Thursday in another connection, the great parliamentary machine is that "on which, after all, in this Parliament-"governed country, everything in the last resort depends." Having submitted their case to the Committee, the Horseferry Road administration cannot now impugn the competency of the tribunal. Nor was there any element of surprise in the impeachment; for the storm has been brewing for years. The Governor has pleaded in defence the silent contentment of the proprietors; but this will not help the Company to get their next Bill passed. The case against the Horseferry Road administration was based upon two charges—over-capitalization, and mismanagement of the business. The official defence against the former was that the outlay could not be helped. The Company had to go to Beckton, and must be prepared to deal with an exceptional emergency demand. Mr. Field was challenged to put this into figures, and he did so to the tune of £1,900,000. Taking this valuation as correct, however, the Committee point out that it falls far below the amount of over-capitalization of the Company. As regards the charge of mismanagement, to prove this generally touches, as we have remarked, upon the borderland of impossibility in so far as it involves the proving of a negative. Yet the Committee had evidence of alleged specific blundering in the purchase of coal, the disposal of coke, the traffic in sulphate, the lighterage of coal, the rating appeals, and other matters. Their conclusion upon these points has already been given. They admit that there has been mismanagement; but they leave this for the proprietors to deal with. It is not a hopeful outlook. All experience goes to show that the powers of proprietors in a company over the directorate, although theoretically supreme, are practically *nil*. It is not necessary to depend, for illustration of this truth, upon the example of a Gas Company. Any Railway Company will serve for the purpose. What part, one may ask, had the shareholders of the Great Central Railway Company in bringing about the existing state of affairs in this concern? They could not help themselves, nor did Parliament help them. Now the old order has changed by the course of time; but the ordinary stock has fallen to 35; and all prospect of a dividend has vanished. *Absit omen!*

The Report and Accounts of The Gaslight and Coke Company.

THE Directors' report and the statement of accounts relating to the past half-year's working of The Gaslight and Coke Company were issued last week—a day in advance of the report of the Powers of Charge Committee, which happy circumstance saved the Board from the necessity of stating its nature in their own report. The customary preliminary announcement of the result of the half-year's trading informed the public that the credit balance would enable the Directors to recommend the payment of the full statutory dividend of £4 18s. per cent., equivalent to 12¼ per cent. on the old system, and to carry forward a balance of £139,557. Paying the same rate of dividend this time last year, the surplus was £51,855; and in January it was £53,759. This result appears on the face extremely satisfactory. The wonder is that the publication of the figures was not accompanied by an intimation of a reduction in the price of gas. This, at all events, is what might have been expected from the large margin of profit. The silence of the Board on the subject of a reduction of price, however, throws a reflection on the accounts—not in regard to their correctness, of course, but as regards the substantiality of the showy improvement. In their report, the Directors do not offer a word of congratulation to the proprietors on the state of the finances of the Company; but they do so in regard to the increase in the gas consumption, of 1·6 per cent. The reason for this reticence is contained in the third paragraph of the report, which states that the price of coals has risen again. Residuals helped the Directors grandly during last half year; but, naturally, nothing is said about what may happen in the current or next half year. The reference in the report to the rejection of the Company's Bill is guarded. It declares that the loss of the measure is "greatly to be regretted," and that the Directors have in consequence been compelled "to restrict the extension of "labour-saving appliances and other contemplated improve-

"ments at the Company's several works which have for "their object increased economy in working." The investigation conducted by Sir James Rankin's Committee is briefly mentioned, without comment.

The capital accounts are made out according to the Consolidation Act of last year, showing at a glance the effect of the conversion. The net capital expenditure for the half year was £66,266—mostly on distribution. The sale of gas brought in £1,609,118, being an increase of £65,603. The residuals were £83,250 better than for the corresponding half of last year. On the other hand, coals cost £71,950 more. Salaries of engineers and officers at works show a small, but positive diminution—which is saving in the wrong place. It would be well for somebody to ask what are the prospects of works managers and young officers in the Company's service. Office salaries are not on the decline. The carbonizing wages are being economized. This change is small, but is in the right direction. Public lighting shows a slight falling off, which may be due either to electricity or to the incandescent system. Rates and taxes are up again. An entry of £2500 appears for the workmen's compensation account. This is rather over ½d. per ton of coal carbonized. The quantity of unaccounted-for gas is low; being only 4·4 per cent. The proportion "used on works" is very high, 1·4 per cent. The amount of saleable stores in hand is comparatively small. The sum outstanding on the automatic meter fittings account has further risen to £298,555. A little more detailed information respecting this branch of the business would certainly be well received.

The South Metropolitan Report and Accounts.

THE most salient feature of the South Metropolitan Company's financial position, as revealed in the half-yearly report and accounts, is the fact that the Directors have been able to reduce the price of gas by another penny. Their present price of 2s. 1d. per 1000 cubic feet is the more noteworthy as the reduction has so quickly followed a previous one of equal amount, notwithstanding the rising coal market. Indeed, when all the circumstances are considered, this further remission presents an aggressive aspect. The references to it in the report ring like a challenge to Fate. Yet one may feel sure that the Directors know what they are doing. They have now a disposable profit balance of £192,174, as compared with £189,769 at this time last year, with gas at 2s. 3d. per 1000 cubic feet. The report states that 1d. per 1000 cubic feet all round is £40,000 a year to the Company, or £20,000 on the half year. Though the Company will have to pay £70,000 more this year for their coal, they obtained £64,176 more in the past six months for residuals. At this rate, and with their fast-growing consumption—9·5 per cent. for the half year—the price will be down to "level money" after Christmas. Meanwhile, the undivided balance is nearly £30,000, the reserve fund has been made up to £115,715, and the insurance fund stands at £52,381. Altogether, the Company have reserves amounting to £197,952. Reduction of selling price is therefore in the strictest order. The report concludes with a reference to the relations between the Company and their workpeople.

Accounts such as these do not need very much comment. The revenue from gas was £521,551, as compared with £518,073 with the price a penny higher. In rental alone, therefore, the loss by the reduction was amply recovered. A revision of stove-rentals appears to have been made, for though the number at rent has increased, the revenue from this source has fallen from £15,034 to £12,218. Residuals, as already remarked, have responded nobly to the improvement of trade. Coke brought in £46,147 more, all the other entries show an increase, and sulphate has leaped from £12,016 to £31,051. On the whole, residuals have risen from £159,450 to £223,626. Coal, on the other hand, cost £285,505, as compared with £252,781. Salaries of works' officers have risen from £6957 to £8067; wages are more; and repairs and maintenance are much higher. The total cost of gas manufacture has risen from £397,853 to £448,092. Distribution charges also take some of the extra earnings. The whole expenditure on revenue account stands at £583,720; the gross balance being £192,174, compared with £189,769 for the corresponding period of last year. As usual, the Company have sold off their products very closely. The amount of the suspense account for consumers' fittings is under £20,000. The difference between this and the corresponding entry in The Gaslight and Coke Company's balance-sheet—nearly £300,000—is very striking. There has been a tremendous amount of comparative criticism of the finances and working of these two Companies of late, and the simultaneous appearance of the new half-year's accounts of the undertakings will revive these exercises.

The North British Association Meeting.

THE annual meeting of the North British Association of Gas Managers at Stirling last Thursday was a very pleasant gathering; and it is gratifying to note that it was one of the most largely attended meetings ever held under the auspices of the Association. This is about all that can be said of the meeting. Following the example of Mr. Carlow, the Secretary of the Association, we feel disposed to read the members a little lecture upon their duties to the Association. That the Secretary should only have been able to get one paper out of a membership of nearly 250, and should have been obliged to go outside the Association for two-thirds of the programme he sent out, is an experience which, it is to be hoped, he will not require to repeat. There is plenty of talent within the Association; so there can be no excuse upon that score. There are plenty of subjects which are not yet by any means threadbare. All that is required is that the existing—it is to be hoped, only temporary—apathy should be thrown off. No special effort is needed; vigour and prosperity should flow "automatically," were the members awake to the necessity for their doing something. It should be an honour to be allowed to lay a subject before the Association; and it should be a profit, to the reader as well as to others, to hear it discussed, even though the criticism should be somewhat sharp. But to descend to a lower plane, the contribution of a paper to a scientific body is one of the very best "advertisements" of talent; and the younger members might take note of this. The representation of the North British Association as a slumbering colossus is doubtless going a little beyond the fact; for the Association is not yet asleep, as witness the increase of members from 236 to 245, and the very informative paper which was read by Mr. Yuill. The Association were exceedingly fortunate in the other two communications they had before them—particularly the latter one, which is a new subject. Two items of business which were transacted deserve to be commended. One was the report that two members in penury had been relieved, which is, indeed, a work that cannot be over-estimated. The other is the placing of Mr. Peter Watson, late Manager of the Stirling Gas Company's works, upon the list of honorary members. This is only in accordance with the principle that members of long standing, when they cease their active labours, shall not break their connection with the Association, but shall be honoured by being asked to step up higher. On the social side, the Association is as strong as ever, which is saying a good deal; for sociality has always been a strong element in the North, and many in the South are aware of how special a feature of the annual event is the excursion of the Scottish Association. This year's was among the best within recollection; and in this matter too much praise cannot be given to the Secretary and Mr. J. M'Gilchrist, for their skilful organization, the completeness of their arrangements for the occasion, and their attention to the comfort of all who were present.

Litigation and Insurance under the Workmen's Compensation Act.

THE cry is frequently heard that the claim made for the Workmen's Compensation Act by its authors—that it would, to a great extent, relieve workmen from the necessity of enforcing their rights by action—is not being justified by events; and that the Act has, in reality, given rise to an increase in litigation. This cry has generally been raised by those whose political bias deprives their opinion of much of its weight; but we regret to observe that the complaint has now received the endorsement of one of the chief organs of the Government. "The Times" of yesterday week, in a leading article of considerable length, declared that "the "multitude of appeals arising out of the Workmen's Com-"pensation Act is becoming a matter of grave concern. No "small part of the time of one of the divisions of the Court "of Appeal is devoted to hearing questions of construction "of the provisions of a statute which was intended to prevent "litigation and lawyers' bills." We have so constantly expressed our opinion that the probabilities were against, and that the event has not fulfilled, the expectation that the Act would permanently increase litigation in respect of compensation for accidents, that we prefer to quote, in reply to this outburst on the part of "The Times," and to all similar criticisms, the expressed opinion of our contemporary the "Law Quarterly Review," which certainly cannot be accused

of speaking from bias, and has, obviously, special means of gauging the situation. Referring to the fact that the "Law "Reports" for the June quarter contain at least seven cases on the Act, and that the July number brings the total up to about a dozen, the "Law Quarterly Review" proceeds:

> Critics, however, who suggest that the number of reported actions for compensation is a proof that the Act has failed in one of its main objects, go beyond any conclusion the facts warrant. Whenever a fundamental change is introduced into any branch of the law, the immediate result must be an increase of litigation. It is only by experiments in the Law Courts that the exact result and extent of a new enactment can be tested, and as long as English human nature remains what it is, workmen who can gain by a broad interpretation of an Act will attempt to get its meaning extended by the Judges; whilst employers who wish to lessen their liabilities will contend for the narrowest possible interpretation. After a time, however, the meaning of each important provision will become fixed. Experimental actions will cease, because everyone can foretell the result of the experiment. In other words, parliamentary legislation will always for a time be followed by active, though subordinate, judicial legislation. But judicial legislation will by degrees decrease, provided only that Parliament can abstain from further alterations of the law.

When it is further remarked that Mr. Thomas Burt, the well-known Labour and Radical Member, in his monthly circular to the Northumberland miners, says, respecting the Act, that "there has certainly been less litigation than was "predicted (by the opponents of the measure)," we think it is obvious that "The Times"—and many other people with whom the wish has been father to the thought—have jumped to a premature, and probably incorrect, conclusion.

We may add that one of the arguments recently urged in the "JOURNAL" in favour of employers adopting mutual schemes under the Act, finds confirmation in Mr. Burt's circular. He says: "This happy exemption from costly "and vexatious litigation has no doubt been largely due to the "fact that employers and workmen, through their respective "Unions, have settled claims by mutual agreement." As bearing on the question of whether meeting liabilities by insurance or by mutual scheme is the cheaper plan, we observe that in the accident department of the Guardian Assurance Company for the year 1898, the premiums amounted to £12,771. The claims were £2992, the expenses £3975; showing a balance of £5814 at the end of the year. The report states that "there has been great competition "for business under the Compensation Act, but that the "Directors are satisfied with the commencement made." We should rather think they were; but are the insurers?

Pensions for the Aged Deserving Poor.

AN interesting step has been accomplished in the quest for a practicable Old Age Pension Scheme for the Deserving Poor. It is not a little curious that so short a time after the dismissal of the idea as impracticable by a couple of Royal Commissions, a Committee of Parliament should be in a position to report affirmatively on the general proposition that something better than poor-law relief for deserving cases is desirable and expedient. After this, who shall say what is or is not economically possible? It is not too much to remark that the political world, and also the world of industry and commerce, will hear a good deal more henceforward of this subject. We have always believed that the Workmen's Compensation Act would infallibly lead to legislative action on behalf of the aged deserving poor; and here is the first corroboration of the forecast. A problem which appears insoluble when stated as a general proposition may be tackled more successfully when divided into departments. Mr. Chaplin's Committee, however, have been able by a large majority to arrive at a general conclusion in regard to the matters referred to them. They start by accepting the contention that the existing system of poor-law relief is cruel to aged persons left destitute through no fault of their own. The great objection raised by the Royal Commission to all pension schemes was that they would discourage thrift, and would cost the country too much. The result was a formal *non possumus*, which the new Committee have succeeded in putting aside. When the text of the report comes to hand, we shall be able to explain how this has been done. For the present, it is only possible to congratulate the Committee on their happy deliverance. They find themselves able to declare that every aged destitute person of good character ought to have a national pension of from 5s. to 10s. per week, paid through the Post Office —provided half by the rates and half from Imperial taxation. The business would be administered by local authorities specially constituted for the purpose. If a number of the largest employers of labour were added *ex officio* to these bodies, we think they would be rendered more efficient.

WATER AND SANITARY AFFAIRS.

IT was scarcely to be expected that the Water Committee of the London County Council would allow their year to close without having another shot at the London Water Companies. Hints had been thrown out that the Committee and the Engineer were watching closely the present condition of the Thames, and that the result of this increased vigilance would soon be made known. It appeared on the *agenda* for last Tuesday's meeting, in the shape of a long report by the Committee, followed by a formidable extract from the interim report of the Royal Commission. It is still upon the paper, but it is opposed by Mr. Easton. In addition to this, there was a report from the Rivers Committee, showing how they had been stirring up the Thames Conservancy on the subject of the pollution of the river. We need not deal with the latter document, except to refer to one satisfactory sentence in it, to the effect that the Council's Chemist (Dr. Frank Clowes) has expressed the opinion that there is no danger to the Thames water supply from the cesspools in the Staines district. At the same time, according to the Water Committee's report, the examinations which the Council have authorized him to make of the water supplied by the Companies, have been extended to samples obtained from above their intakes. This is perhaps to be commended, as the results of the analyses of the waters as sent out to the consumers will show the efficiency of the Companies' filtering arrangements. Dr. Clowes is making complete examinations of samples of water taken daily from the mains of each of the Companies; but in many instances his conclusions do not coincide with the results obtained by Sir William Crookes and Professor Dewar, nor do theirs agree with Sir Edward Frankland's. According to the Committee, these distinguished Chemists draw their samples always from the same stand-pipes; whereas Dr. Clowes takes his from the mains at different places. The Committee possibly wish it to be inferred that a specially prepared supply is laid on to these stand-pipes, just as many people imagine that a highly-enriched gas is sent by the Gas Companies to the various testing-stations, and that it is only by the adoption of the "peripatetic" system of testing that the lapses of the Companies will be detected. Moreover, Dr. Clowes submits his samples to microscopical examination, while the other Examiners do not. The microscope is an exceedingly useful instrument; but its revelations very frequently cause a great deal of unnecessary alarm. The Council's Chemist has found that in 75 out of 208 samples of water taken hap-hazard from the mains, at points which are not specified, Dr. Koch's "standard of 100 microbes per cubic centimetre "was exceeded." This is a very alarming statement; but we question whether its enunciation has been attended by any more serious consequences than was the utterance of the "curse" in the well-known Ingoldsby legend. A very eminent bacteriologist has deprecated this pinning of faith to a standard "made in Germany." Sir W. Crookes and his colleague, notwithstanding the assertions of the Committee, have lately increased the number of the samples of water examined, so as to meet the objection occasionally urged that there were certain districts of London which were "not served by special branch works "or clear-water wells" from which they previously took their samples. In their report for June, they say that the mean of 77 samples of filtered New River water examined by them was 20 microbes per cubic centimetre; of 201 samples of filtered Thames water, 30 microbes; and of 26 samples of Lea water from the East London Company's well, 19 microbes. We do not think, therefore, that the public have much cause for alarm in regard to the quality of the water supplied to them.

Having attacked the quality of the water, the Committee turned to the quantity. They cited figures to show that the Thames fell far below its average flow in May and June, while the quantity of water abstracted by the Companies was greater. It is true that in June they drew 11,688,151 gallons more water daily from that river, and 7,282,134 gallons more from the Lea, than they did in the corresponding month last year; but there were 21,153 additional services to provide for. The Committee take a rather desponding view of the future. They think that, even supposing a wet season should come now to "spoil "the holidays," as the Chairman is reported to have said to a newspaper representative, the natural flow of the river will

be considerably below 300 million gallons a day, out of which the Companies will probably require rather more than 130 millions; so that this will only leave 170 millions to flow over Teddington Weir. The Chairman of the Council (Lord Welby) referred to this matter in his annual address last Tuesday, and ventured to suggest the possibility of the Thames proving insufficient, considering the demands upon it. Of course, the object was to urge the necessity for carrying out the Council's Welsh scheme with as little delay as possible. The Committee acknowledge that if it came to be a question between restricting the supply to the public and allowing the Companies some temporary latitude in regard to their draughts from the Thames, the Local Government Board and the Thames Conservancy would "properly" adopt the latter alternative. The former body, as mentioned last week, have been appealed to to make some public announcement as to the effectiveness of the preparations which have been carried out to prevent a repetition of last year's troubles. This is a perfectly legitimate action for the Committee to take; and it was only natural that other endeavours should be made to obtain an official pronouncement on this matter. The question put to the President of the Local Government Board in the House of Commons on Friday last by Mr. Pickersgill, the member for Bethnal Green, elicited it. Mr. Chaplin was able to give the honourable member some specific information as to the progress made by the Water Companies in linking up their systems, the result of which has been that the reservoirs of the East London Company now contain upwards of 1100 million gallons of water. As the Company sent out in June about 45½ million gallons daily, it does not require any very elaborate calculation to find how long their store would last, supposing it were possible all their resources—two rivers and several wells and springs—were to be cut off, which it is not. Both before and since the passing of the Intercommunication Act, the Companies have been busily engaged in carrying out, at great expense, measures to meet the demands of the East-end during the present summer; and Mr. Chaplin sees no reason to doubt that they will prove effectual.

North of Ireland Association of Gas Managers.—The annual meeting of this Association will be held in the City Hall, Dublin, next Tuesday, under the presidency of Mr. J. W. Auchterlonie, of Mullingar. According to the programme issued by the Hon. Secretary (Mr. J. Whimster, of Armagh), there will be three papers and a lecture. Mr. S. B. Langlands, of Coleraine, will contribute some "Notes on Building Construction in Small Works;" Mr. W. A. Reid, of Longford, will deal with "The Working of a Semi-Regenerative Setting;" and Mr. R. B. Anderson, of Westminster, will give his views in favour of "Differential Rates for Gas." The lecture will be delivered by Dr. C. R. C. Tichborne, F.I.C., Gas Examiner to the Board of Trade, Dublin, who is an honorary member of the Association; his subject being "The Continuous Method of Estimating Impurities in Coal Gas." Permission has been given to visit the works of the Alliance and Dublin Gas Company and Guinness's brewery. Preliminary arrangements have been made for a visit to Bray and the Dargle Glen and Powerscourt the day after the meeting.

The Singapore Municipality and the Gas-Works.—The manifestly unfair offer received by the Singapore Gas Company from the Municipality for their property (as noticed last week) has been very properly rejected. The offer of $300,000 we read is only a "formal" one; and it is to be hoped that it will quickly develop into something which may be accepted as a reasonable one. The Directors of the Company have cabled that they cannot entertain anything below £55,000, or about $550,000; and this certainly appears to be an equitable figure, having regard to the improved position of the concern. Last year a profit of £3650 was earned; and there is every prospect that this will not only be maintained but increased. Thus, the £55,000 is only equivalent to fifteen years' purchase. The Municipality, however, do not, in their calculations, countenance the turn in the Company's fortunes; but they take, as a basis, the results of the working of five particularly lean years. These years were 1892 to 1897, during which time the great fall in silver weighed heavily on such Companies as this, and when, of course, very little profit could be made. Taking these unfortunate years, the offer of the Municipality works out to 16⅜ years' purchase; but, at the present rate of exchange, the Company are realizing a 5 per cent. profit. If, therefore, the Municipality are righteously or liberally inclined, they will apply the 16⅜ years (for which they may have a peculiar fancy) to the last or the current year's profits. This would give the Company £10,000 more than they are asking; but the figure would be much nearer the actual value of the property to the Company than the miserable sum the Municipality are tendering.

THE PRIZE ESSAY ON SULPHATE OF AMMONIA.

THE UTILITY OF SULPHATE OF AMMONIA IN AGRICULTURE.

By James Muir, M.R.A.C.

(*Continued from p.* 227)

WHEAT.

Like all other plants of the natural order Gramineæ—that is the cereals and grasses—wheat benefits to an exceptional extent from the judicious application of nitrogenous manures. This is not due to any special requirement of nitrogen on the part of the members of this order, but probably to the comparative difficulty they have in obtaining it—owing perhaps to their habit of root development, or in many cases to the season of the year when their most active growth takes place. Both corn and straw are largely increased by nitrogenous manuring.

Sulphate for Continuous Wheat Growing.

Experiments in continuous cropping and manuring are important as indicating with far greater certainty than rotation experiments the characteristic results of applying particular manures to particular crops. In the experiments on continuous wheat growing at Rothamsted, the following results per acre per annum have been obtained, on the average of forty years, 1852 to 1891 inclusive:—

Table XIV.

Manuring.	Corn.		Straw.
	Bushels.	Weight per Bushel.	
		Lbs.	Cwt.
No manure	13	58¼	10⅝
Mineral manure only	15	58⅛	12⅜
Ammonia salts = 86 lbs. of nitrogen.	20½	57¼	18¼
Nitrate of soda = 86 lbs. of nitrogen*	22¾	56⅝	23⅜
Ammonia salts and minerals	33½	59¼	33⅜
Nitrate of soda and minerals*	35⅝	59	39⅛

* Nitrate of soda = 43 lbs. of nitrogen only, applied in last seven years.

These figures are a good example of the usual relative increase yielded under the different systems of manuring. Mineral manures alone (sulphates of potash, soda, and magnesia, and superphosphate of lime) gave little increase compared to the unmanured plot; and the plots receiving nitrogenous manures only, though producing more than that receiving minerals only, were yet far behind those manured with both minerals and nitrogen. Another important point is that with nitrogenous manures only—that is, when the soil was well supplied with nitrogen, but was deficient in the other constituents of plant food—the weight per bushel of corn was diminished. This almost certainly implies that the quality and value of the corn was less than on the unmanured plot. As a matter of fact, the average weight per bushel on the two plots manured with nitrogen only was lower than under any other system of manuring experimented with. On the other hand, where minerals were supplied with nitrogen, the quality of the grain, as indicated by the weight per bushel, was a good deal higher than that of the unmanured plots.

It is, however, with the comparison afforded between ammonia salts and nitrate of soda that we are at present most concerned. It must be remembered that these two manures were used so as to supply the same amount of nitrogen to the crop, not in equal weights of the manures themselves. Thus, 400 lbs. per acre of ammonia salts were compared with 550 lbs. per acre of nitrate of soda. This must be clearly remembered, as it is important in drawing conclusions from the experiments as to the relative economy of different manures. In all experiments to be quoted comparing the action of sulphate and nitrate, the same quantity of nitrogen was applied per acre in the two forms, except where it is distinctly stated that equal weights of the manures were used.

In the Rothamsted experiments, nitrate of soda gave the larger increase; but the weight per bushel of the corn was distinctly lower than that produced by ammonia salts, whether the manures were used alone or with minerals. The proportion of grain to straw is also worth noticing, for generally a crop giving a large proportion of straw is

more liable to be laid before harvest, and in many seasons to suffer from blight. Averaging the two plots dressed with ammonia salts, there was 181 lbs. of straw to each 100 lbs. of grain; but with nitrate of soda, there was on the average 210 lbs. of straw to each 100 lbs. of grain.

In the experiments carried out at Woburn on continuous wheat growing, similar results were obtained on the average of twenty years. The following was the return per acre per annum with the manures mentioned:—

TABLE XV.

Manuring.	Corn.		Straw.		
	Bushels.	Weight.			
		Lbs.	Cwt.	Qrs.	Lbs.
No manure	15·3	57·3	15	0	9
Mineral manure	15·1	57·8	15	2	13
Ammonia salts = 50 lbs. of ammonia	23·8	57·3	23	1	20
Nitrate of soda = 50 lbs. of ammonia	23·6	55·2	23	2	27
Ammonia salts = 50 lbs. of ammonia and minerals	30·2	58·7	29	0	6
Nitrate of soda = 50 lbs. of ammonia and minerals	31·2	57·8	31	1	13
Ammonia salts = 100 lbs. of ammonia and minerals*	37·2	58·7	36	3	18
Nitrate of soda = 100 lbs. of ammonia and minerals*	34·0	57·0	38	0	6

* Nitrogenous manures applied in alternate years.

These results are very similar to those obtained at Rothamsted, but are more favourable to the use of ammonia salts. When the nitrogenous manures were used alone, ammonia salts and nitrate of soda gave practically equal yields. With minerals, a moderate dressing of ammonia salts gave one bushel per acre less than nitrate of soda; but when double the amount of each of the nitrogenous manures was given, ammonia salts produced over three bushels more than nitrate of soda. The lower weight per bushel of the corn grown with nitrate was even more marked than in the Rothamsted experiments, especially when used alone or in the heavier dressing with minerals. It should also be noticed that where moderate dressings of the nitrogenous manures were given with minerals, the extra weight per bushel of the corn produced by ammonia salts partly compensated for the smaller quantity; the difference in the total weight of corn between the two nitrogenous manures being about 30 lbs. per acre. The lower proportion of straw to grain with ammonia salts is also seen—though not so markedly as at Rothamsted—except with the heavy dressings of the nitrogenous manures, where the additional quantity of nitrate applied seems to have been used by the crop chiefly in the formation of straw.

As bearing on the quality of the wheat grown with different manures, it is interesting to notice the relative values of the wheat grown on the various plots at Woburn, in the twenty-first year of experiment—1897.* The values per quarter fixed by practical valuers were—

TABLE XVI.

No manure	37s. 0d.	per qr.
Minerals only	37 0	,,
Ammonia salts = 50 lbs. of ammonia	37 0	,,
Nitrate of soda = 50 lbs. of ammonia	35 0	,,
Ammonia salts = 50 lbs. of ammonia and minerals	38 6	,,
Nitrate of soda = 50 lbs. of ammonia and minerals	36 0	,,
Ammonia salts = 100 lbs. of ammonia and minerals*	38 6	,,
Nitrate of soda = 100 lbs. of ammonia and minerals*	36 6	,,

* Nitrogenous manures applied in alternate years.

The average value of the corn from the three plots receiving ammonia salts was 38s. a quarter, against an average of 35s. 10d. on the plots receiving nitrate of soda—that is, ammonia salts raised the value of the corn 1s. a quarter above the produce of the unmanured plot, but nitrate reduced the value to 1s. 2d. below that of the unmanured corn. These values refer to one season only; and therefore too much stress must not be laid upon them. But they are probably fairly representative; being confirmed by the weight per bushel of the corn, recorded over a long series of years both at Rothamsted and at Woburn, and by similar results which will be noticed in connection with other crops.

For wheat, therefore, the results of these experiments seem to show that there is not much difference in the bulk of the corn produced by a given amount of nitrogen in the manure, whether in the form of ammonia salts or nitrate of soda; but the quality of the corn is distinctly better from ammonia salts. Both at Rothamsted and Woburn, the average rainfall is lower than in many parts of the country; and therefore the results obtained are perhaps on that account more favourable to nitrate than would be the case in moister climates.

The amount of straw, on the other hand, is greater with nitrate of soda, though this is counterbalanced by the crop's greater liability to be laid, and less power to resist mildew. If too much nitrogen be applied, either in comparison to the mineral plant food present in the soil, or to the plant's requirements, harm is more likely to result when nitrate is used than with ammonia salts.

SULPHATE FOR WHEAT IN ROTATION.

As to the best way of using sulphate of ammonia for wheat under the conditions of ordinary farming, some light is afforded by the experiments of the Norfolk Chamber of Agriculture in 1888.* These were carried out at three centres; but the results of two stations only will be considered at present, for at the third—Flitcham—no mixture of manures which did not contain potash was effective, so that the inclusion of its results would only serve to mask those of the other two stations for our present purpose. The following table shows the average yield per acre at the two stations, Whitlingham and Cawston:—

TABLE XVII.

Manuring.	Corn.	Straw.		
	Bush.	Cwt.	Qrs.	Lbs.
1 cwt. sulphate of ammonia, sown in autumn	23·92	17	2	16
2 cwt. sulphate of ammonia, sown in autumn	23·13	16	2	19
2 cwt. sulphate of ammonia, half sown in autumn, half in spring	24·93	18	0	2
No manure	22·67	16	1	14

In the first place, as explaining the small increase obtained by any of these manurings, it should be mentioned that the season was on the whole unfavourable to their action, and that in the district where the experiments were carried out, farmyard manure seems necessary to produce a full crop of wheat. The actual increase obtained by the various dressings of nitrogenous manures is, therefore, less than would be usually obtained. Comparing the yields of the different plots, however, we see that the limit of economy was reached for autumn sowing at 1 cwt. per acre of sulphate of ammonia; 2 cwt. giving less corn and less straw than 1 cwt. When half the sulphate was applied in the spring, better results were obtained, as would be expected from what has already been said on this point.

One point should be mentioned in connection with the results obtained at Flitcham, the station not included in the above table. It will be remembered that the soil here was remarkably deficient in potash, so that without potash manuring other artificials gave a very small return; but with potash they gave a comparatively large increase. The results afford a very good example of the fact already noted, that the presence of potash seems particularly important if sulphate of ammonia is to produce its full effect; for that manure gave relatively worse results at Flitcham than at the other two stations—Whitlingham and Cawston—in the soils of which available potash was comparatively plentiful.

In experiments with wheat carried out on sterile sand, Pagnoul has found the same thing.† When a complete manure was supplied, there was little difference in the results obtained from the two manures; but if potash were deficient, nitrate was twice as effective as sulphate. In a second year's experiment,‡ he found that, while the addition of potash to nitrate increased the yield in the proportion of 13 : 10, potash with sulphate increased it as 26 : 10. The weight of individual grains of corn was increased by potash with nitrate in the proportion of 14 : 10, and with sulphate of ammonia in the proportion of 17 : 10.

* "Journal of the Royal Agricultural Society of England," Vol. IX., Third Series, Part 3.

* "Journal of the Royal Agricultural Society of England," Vol. XXV., S. S. Part 1.

† "Comptes Rendus," 111. ‡ "Ann. Agron," 17.

A possible cause of this unfavourable effect of sulphate of ammonia when potash is deficient has been mentioned already—viz., the need of potash for the formation of carbohydrates, and the importance of carbohydrates in the plant for the formation of asparagine from the nitrogen of ammonia salts, preparatory to the further formation of albuminoids, &c. The nitrate of soda, also, may perhaps give its better effect under these conditions, by the soda of the manure taking the place of potash to some extent in the plant, and so partially supplying the deficiency. The evidence on this point is conflicting; but the results obtained by some investigators seem to make this explanation possible.

The Rothamsted wheat experiments have already been quoted to show that the best way to apply ammonia salts is to put on a small part of the dressing in the autumn, and the rest—about three-quarters—in spring. Another question arises as to whether the spring dressing should be put on at one time or in several applications. It is generally known that nitrate of soda gives a better return when applied in two or three dressings. Should sulphate of ammonia be used in the same way? An early experiment at Rothamsted answers this question as far as heavy land is concerned. In the wheat experiments of 1845, two plots were manured with ammonia salts—one receiving all the manure at one time in the early spring, the other in four different dressings. The results were as follows:—

TABLE XVIII.

	Corn. Bush.	Pks.	Straw. Lbs.	Per 100 of Corn.
Ammonia salts in one dressing . .	33	1½	.. 4058	190
„ „ in four dressings. .	31	3¼	.. 4266	215

There was evidently an advantage in applying the whole of the manure at once. The lower yield of grain, the increase in straw, and the large increase in the amount of straw per 100 of grain, all showed that with four dressings part of the manure had been applied too late in the growth of the crop. As already mentioned, very light soils form a possible exception to the rule of applying all the sulphate at once.

Practically a dressing of about 1 cwt. of sulphate of ammonia per acre will generally be found enough for wheat grown in rotation. If the crop be very weak and thin after the winter, a rather heavier dressing—up to 2 cwt. as a maximum—may be given; while on the other hand, if the land be in high condition, ¾ cwt. or even ½ cwt. will be better.

BARLEY.

EFFECT OF SULPHATE ON YIELD.

For this crop, we find that nitrogenous manures are even more effective than for wheat. Otherwise the differences between the two crops are not very important. We will first consider the use of sulphate of ammonia with reference to the yield only. At Rothamsted, Sir John Lawes and Sir Henry Gilbert obtained the following results per acre per annum on the average of forty years' experiments in continuous barley growing:—

TABLE XIX.

Mineral Manures.	No Nitrogen.		Ammonia Salts.		Nitrate of Soda.	
	Corn.	Straw.	Corn.	Straw.	Corn.	Straw.
	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
No mineral manure . . .	16½	1044	29	1793	32¾	2127
Superphosphate	21⅝	1210	42⅜	2674	45¾	3018
Sulphates of potash, soda, and magnesia	18	1076	31⅜	2011	33½	2322
Superphosphate and sulphates of potash, soda, and magnesia	22⅜	1279	43½	2904	45½	3186

The increase from the nitrogenous manures, even when applied alone, was considerable, while with minerals in addition heavy crops were obtained. The relative importance of superphosphate with the nitrogenous manures, and the small effect from the additional use of potash and other minerals, must be noticed. Thus while superphosphate and either of the nitrogenous manures gave a crop about half as large again as the nitrogenous manure alone, the sulphates of potash, soda, and magnesia yielded with nitrate of soda only ¾ bushel more corn than the nitrate alone, and with ammonia salts 2⅜ bushels more. In the same way, the addition of potash and other minerals to superphosphate and nitrate caused a decrease of ¼ bushel of corn; and where the nitrogen was in the form of ammonia salts there was an increase of ¾ bushel. This is another instance, though not a very marked one, of the relative importance of potash with ammonia salts, and the slight or even injurious effect of its use with nitrate of soda.

Passing on to compare the effects of ammonia salts and of nitrate of soda, we see that the latter, whether used by itself or with mineral manures, gave somewhat the higher yield. The higher proportion of straw from nitrate is probably on the whole a disadvantage, as making the crop more likely to be laid—an effect more injurious to the value of barley than to that of wheat.

In the Woburn experiments, the results are similar to those obtained at Rothamsted. It will be remembered, however, that the crops manured with ammonia salts became markedly unhealthy towards the end of the first twenty years of experiment; owing probably to the continual loss of lime from the soil, occasioned by the use of ammonia salts in considerable quantity year after year.

One result not shown by the Rothamsted experiments must be noticed. On plots at Woburn dressed annually with minerals and in alternate years with nitrogenous manures, a marked difference was shown between barley and wheat. In the case of wheat, it will be remembered that, while mineral manures and the residue from the application of nitrate of soda to the previous crop gave only 2 bushels increase over the mineral manures alone, the residue from ammonia salts gave about 8¾ bushels increase. (See Table XII.) In the case of barley, the residues of the two nitrogenous manures gave practically identical results, as will be seen in the following table, giving the average produce per acre per annum from the manures mentioned for the first fifteen years of experiment. The yield from mineral manures only was 22·6 bushels for the same period.

TABLE XX.

	Ammonia Salts.		Nitrate of Soda.
Minerals and nitrogenous manures	44·9	..	50·1
Minerals and residue of previous year's nitrogenous manures	31·0	..	31·1

It should be observed that, in these experiments, the residue from ammonia salts was as effective on barley as on wheat; but the residue from the previous application of nitrate of soda was more effective on barley than on wheat.

On farms worked in the ordinary way, sulphate of ammonia gives precisely similar returns compared to nitrate of soda as in the continuous experiments mentioned. For example, in an experiment carried out in 1887 by the Norfolk Chamber of Agriculture at Whitlingham, ¾ cwt. of sulphate of ammonia with minerals gave exactly the same return of corn as 1 cwt. of nitrate with minerals, and rather more straw; double the quantity of nitrate gave much better results; while doubling the sulphate yielded no additional crop. It must be remembered, however, that 1887 was a remarkably dry year, and would therefore favour the action of nitrate of soda, and would also preserve the crop from any likelihood of suffering from the large dose of nitrate.

EFFECT OF SULPHATE ON QUALITY.

So far the yield per acre only has been considered; but the quality of the grain for malting purposes is more important from an economical point of view than the mere quantity. The quality of barley is, however, a thing upon which it is difficult to obtain accurate statistics, and one which can hardly be expressed by figures. Unlike wheat, the weight per bushel of which is an approximate index of quality, the weight per bushel of barley is a secondary matter. Of course, other things being equal, a high weight per bushel is desirable; and in this respect sulphate of ammonia and nitrate of soda have the same relative effect on barley as on wheat—sulphate giving grain of greater weight than nitrate. In both the Rothamsted and the Woburn experiments this is shown; the average weight per bushel being about half a pound greater with sulphate than with nitrate.

But this is a comparatively unimportant matter; for the maturation of the grain is the chief factor controlling its

malting quality. It has been pointed out that nitrogenous manures in general delay the ripening of the crop; and accordingly we find that they cannot be used in large quantity without spoiling the sample. It will be remembered that this action is less noticeable in the case of sulphate of ammonia than with nitrate of soda, and where there is a full supply of minerals than where they are deficient. We should expect, therefore, that a better malting sample of grain would be produced by the use of sulphate of ammonia than by nitrate of soda, particularly when minerals were also freely supplied; and we shall see that this is the case.

An inquiry was carried out by Tanner* some time ago on this subject, which led him to the conclusion that sulphate of ammonia improves the quality of barley for malting, while nitrate of soda invariably makes it worse.

More recently, Munro and Beavan† have published the results of an examination of the barley grown at Rothamsted under various conditions of manuring for twenty-four years (1872 to 1895). Though from the long storage of many of the samples an accurate valuation was impossible, it was found that they could be divided into four classes—viz., those in which the grain was—

1.—Over average in maturation and size.
2.—Over average in maturation, under average in size.
3.—Under average in maturation, over average in size.
4.—Under average in maturation and size.

The following table shows the number of times in the twenty-four years that each manure produced barley of each of the above classes. The arrangement is in the order of their malting quality.

TABLE XXI.

Manures.	Number of Samples in Each Class. (I.)	(II.)	(III.)	(IV.)
Ammonia salts, superphosphate, and alkaline salts	18	2	4	0
Superphosphate	15	5	3	1
Nitrate of soda, superphosphate, and alkaline salts	13	6	5	0
Nitrate of soda and superphosphate	9	10	2	3
Superphosphate and alkaline salts	10	3	8	3
Ammonia salts and superphosphate	6	9	3	6
Unmanured	6	6	9	3
Alkaline salts	5	1	11	7
Ammonia salts and alkaline salts	3	2	10	9
Ammonia salts	2	4	8	10
Nitrate of soda	2	4	5	13
Nitrate of soda and alkaline salts	1	2	8	13

From this we see that barley grown with ammonia salts with superphosphate and alkaline salts (sulphates of potash, soda, and magnesia) was of higher average malting quality than that produced by any other manuring, producing grain of the highest class in eighteen years out of the twenty-four considered, and was distinctly better than nitrate of soda with the same mineral manures. When the alkaline salts were omitted, nitrate gave a better average sample than ammonia salts—another instance of the importance of a sufficiency of potash and other similar substances when ammonia salts are used. In both the other applications of the nitrogenous manures—that is, by themselves and with alkaline salts—the ammonia salts were distinctly better than nitrate of soda in their effect on the quality of the corn.

The unfavourable influence of nitrate of soda is perhaps due to, or correlated with, its tendency to produce a large proportion of straw, with which is usually found coarseness of the husk enveloping the grain, and a greater proportion of tail corn. Both these points correspond closely with the malting quality as shown in the above table. The following is the average proportion of grain per 100 of straw, and of tail corn per 100 of total grain, from plots at Rothamsted receiving ammonia salts and nitrate of soda, alone and with mineral manures, for the forty years 1852 to 1891.

TABLE XXII.

Manures.	Grain per 100 Straw.	Tail Corn per 100 Total Grain.
Ammonia salts, superphosphate, and alkaline salts	85·0	3·9
Nitrate of soda, superphosphate, and alkaline salts	81·4	4·9
Ammonia salts and superphosphate	90·7	5·3
Nitrate of soda and superphosphate	86·0	5·0
Ammonia salts and alkaline salts	88·0	5·7
Nitrate of soda and alkaline salts	81·5	6·5
Ammonia salts	91·2	6·6
Nitrate of soda	86·7	7·0
Average of four plots receiving ammonia salts	88·7	5·4
Average of four plots receiving nitrate of soda	83·9	5·8

* "Journal of the Bath and West of England Society," Third Series, Vol. XIII.

† "Journal of the Royal Agricultural Society of England," Vol. VIII., Third Series.

In each pair of plots the proportion of grain to straw was higher with ammonia salts than with nitrate of soda; and in each case, except where superphosphate only was added to the nitrogenous manures, the percentage of tail corn was lower with ammonia salts.

To sum up the matter with regard to barley, sulphate of ammonia gives a large increase in the crop; and though this is somewhat less on the average than that obtained from nitrate of soda, yet the gain in quality will generally more than make up for the smaller return. On a crop so liable to be injured by over-manuring, the use of sulphate of ammonia for barley after a sheepfold would, of course, almost always be harmful; but no practical man needs to be told that. After wheat, however, or roots drawn off the land, or under any conditions that impoverish the soil, a dressing of from ¾ cwt. to 1 cwt. per acre is useful and economical. On very hungry or poor land, up to 1½ cwt. may be given with effect. In all cases of manuring barley with sulphate of ammonia, it is important to remember the need of the crop of minerals, both phosphates and potash. These may be present in the soil, either as a natural constituent or as a residue from previous manuring; but if not, they must be supplied as manure, or the sulphate cannot give its full effect.

OATS.

With regard to this crop, there are no records available of experiments carried out over long series of years—such as the wheat and barley experiments at Rothamsted and Woburn. At the same time, the evidence we have on the effect of sulphate of ammonia on oats is so free from contradictions or anomalies, that we need have no hesitation in accepting the conclusions arrived at.

At Rothamsted, experiments on the continuous growth of oats were carried out from 1869 to 1878; but after the first five years, the plots dressed with nitrate of soda became so wet that the crop was badly got in, and the plant was therefore irregular. Taking, therefore, the first five years only, the average results obtained were as follows per acre per annum:—

TABLE XXIII.

Manures.	Dressed Grain. Quantity.	Dressed Grain. Weight per Bushel.	Total Straw.
	Bushels.	Lbs.	Cwt.
Unmanured	19⅞	33¾	10⅜
Mineral manures*	24½	35	13⅜
Ammonia salts	47	35⅞	28½
Ammonia salts and mineral manures*	59	37	41½
Nitrate of soda	47½	35½	27½
Nitrate of soda and mineral manures*	57½	35¾	35

* Mineral manures are in all cases sulphates of potash, soda, and magnesia, and superphosphate.

Without minerals, ammonia salts and nitrate of soda gave almost identical results; but when minerals were given in addition, the difference in the quantity of grain, though slight, was in favour of ammonia salts, as was also the weight per bushel. A somewhat unexpected point was the larger proportion of the straw to the grain produced by the ammonia salts.

If we were to include with the above the yields of the last four crops, obtained in the five years 1874 to 1878 inclusive, the average result would be much more in favour of ammonia salts compared with nitrate of soda; but, as already explained, these years do not furnish such a fair comparison of the action of the two manures.

Other investigators have obtained similar results. Thus Baessler* found, in experiments on a sandy humous soil, that sulphate of ammonia applied to oats gave a yield of grain about equal to that from nitrate of soda; phosphates being supplied in both cases. He found, however, that nitrate produced more straw. Rhodin†, on the average of two years, found sulphate of ammonia distinctly better than nitrate of soda in its results on oats grown on heavy clay.

Amongst experiments carried out on oats grown in rotation on ordinary farms, we may take as typical those conducted by the Glasgow and West of Scotland Technical College on a number of farms in the south-west of Scotland in each of the years 1894 and 1895. The following table

* "Bied. Centr.," 1889. † "Exper. Stat. Record," 4.

gives a summary of the average results per acre, as far as they concern our present subject :—

TABLE XXIV.

Manures.	1894. 13 Farms.		1895. 15 Farms.		Average. 1894-5.	
	Corn.	Straw.	Corn.	Straw.	Corn.	Straw.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
No manure	1375	2867	1358	2654	1366	2760
Sulphate of ammonia, 88 lbs.	1803	3859	1683	3110	1743	3484
Nitrate of soda, 1 cwt.	1749	3847	1473	3000	1611	3423
Sulphate of ammonia, 88 lbs.; superphosphate, 2 cwt.	2018	4132	1812	3017	1915	3574
Nitrate of soda, 1 cwt.; superphosphate, 2 cwt.	2004	4203	1763	3159	1883	3681
Sulphate of ammonia, 88 lbs.; superphosphate, 2 cwt.; muriate of potash, 1 cwt.	2091	4396	1891	3139	1991	3767
Nitrate of soda, 1 cwt.; superphosphate, 2 cwt.; muriate of potash, 1 cwt.	1999	4257	1716	3141	1857	3699

The results of these experiments are very consistent. The increase obtained from all the manures was greater in the wet season of 1894 than in the dry one of 1895; but the average produce of the different plots was in each year in the same order. In every case the plots dressed with sulphate of ammonia—whether used alone, with superphosphate, or with superphosphate and muriate of potash—gave a larger yield of corn than the corresponding plots receiving nitrate of soda. Also when used either alone or with superphosphate and muriate of potash, sulphate of ammonia produced more straw than nitrate of soda; but with superphosphate only in addition to the nitrogenous manures, the reverse was the case. It must also be noticed that in each year nitrate of soda with superphosphate produced a rather better effect than the same manures with muriate of potash in addition. On the other hand, the addition of muriate of potash to sulphate of ammonia and superphosphate raised the yield of both straw and grain. Thus, again, we see the different effect of potash manures with nitrate or sulphate of ammonia.

In each year the most productive plot was that manured with sulphate of ammonia, superphosphate, and muriate of potash, not only of those plots included in Table XXIV., but of others also which were in the scheme of the experiments. Whether this manuring would prove most economical, would, of course, depend on the market price of the manures and of produce. In any calculation on this subject, it is well to remember that the quality of grain is likely to be distinctly better when sulphate of ammonia is used than with nitrate of soda.

In view of the common practice of top-dressing corn crops with nitrogenous manures alone, when any top-dressing is given, it is interesting to note the large increase obtained by the use of mineral manures in addition. On the average of the two years, the gain is equal to about 6 bushels of corn and 2¾ cwt. of straw per acre.

In passing, it may be noticed that these experiments seem to explain an apparent discrepancy between the results obtained at Rothamsted and those of Baessler quoted above. It will be remembered that at Rothamsted, ammonia salts and mineral manures gave a larger yield of straw than nitrate and mineral manures; while Baessler found the opposite to be the case. In the latter experiments, however, phosphates only were given in addition to the nitrogenous manures. Turning to the Scotch experiments, we find both these results confirmed; ammonia salts yielding most straw when phosphates and potash were supplied, nitrate when phosphates only were added.

As a general rule, a dressing of ¾ cwt. to 1½ cwt. per acre will give the best results in practice, though more than 1 cwt. will only be required when the land is in poor condition. Even in the case of ordinary farm land, the addition of minerals to the nitrogenous manure will on the average give a largely increased crop; about 2 cwt. per acre of superphosphate, and the same quantity of kainite, being suitable amounts to apply; or basic slag might be used in place of the superphosphate.

MANGELS.

In considering the results of experiments on this and other similar crops, we are met with a difficulty in estimating the economical effect of manures, because the composition, and consequently the feeding value, of the roots is affected very greatly by differences in manuring. As the root crops are in the great majority of cases grown for consumption on the farm, it is the feeding value rather than the market value that must be taken into account.

Influence of Sulphate on Yield.

At Rothamsted, as far as weight of roots per acre is concerned, nitrate of soda gave better results on mangels grown continuously on the same land than ammonia salts. The following table gives the weight of roots per acre per annum on the average of seventeen years—1876 to 1892—produced by the manurings mentioned :—

TABLE XXV.

Standard Manures.	Alone.	With Nitrate of Soda.	With Ammonia Salts.
	Tons. Cwt.	Tons. Cwt.	Tons. Cwt.
Farmyard manure	15 10	21 8	21 1
Farmyard manure and superphosphate	15 15	22 8	20 6
Superphosphate	4 15	14 14	8 1
Superphosphate and sulphate of potash	4 5	14 16	13 9

These figures again illustrate the principles we have noticed in the case of the corn crops. The addition of nitrogenous manure gave in each instance a large increase; and again we see that, while superphosphate and nitrate of soda give about the same return as those manures with potash in addition, when ammonia salts take the place of nitrate, potash manuring seems essential for a full crop.

Effect of Sulphate on Feeding Value.

When the amount of food for stock per acre is considered, we find different results according to the treatment of the crop as regards farmyard manure. As mangels are comparatively seldom grown without farmyard manure, and as it is well established that they make use of it as well as, or better than, any other crop, we will first deal with the feeding value of the crops at Rothamsted to which farmyard manure was applied. The most important food constituent of the crop is sugar, the percentage of which, and quantity produced per acre, on the plots manured with farmyard manure, on the average of four years, 1877 to 1880, are given in the following table :—

TABLE XXVI.

—	Alone.		Nitrate of Soda.		Ammonia Salts.	
	Sugar per Cent.	Sugar per Acre.	Sugar per Cent.	Sugar per Acre.	Sugar per Cent.	Sugar per Acre.
		Lbs.		Lbs.		Lbs.
Farmyard manure	8·04	2358	6·69	2916	7·20	3409
Farmyard manure and superphosphate	8·10	2487	6·42	3069	6·80	3179

The addition of the nitrogenous manures to the others reduced the percentage of sugar in the roots, especially in the case of nitrate of soda; but the increase in the weight of the crop more than counterbalanced this, so that the weight of sugar per acre is increased. The largest quantity of sugar per acre is produced by farmyard manure and ammonia salts; being 340 lbs. greater than the highest produce of sugar obtained with nitrate of soda—viz., that from nitrate, farmyard manure, and superphosphate. Even the smaller quantity of sugar produced by ammonia salts, farmyard manure, and superphosphate, was still 110 lbs. per acre higher than the best yield from nitrate of soda.

We may conclude, therefore, from this that with farmyard manure ammonia salts produce more feeding material per acre than nitrate of soda, though the weight of the crop may be less.

Without farmyard manure, the opposite is the case; nitrate giving the largest amount of food per acre. The following table shows the percentage and quantity per acre of sugar, on the average of the plots at Rothamsted dressed with superphosphate and sulphate of potash, and with a

complete mineral manuring, the minerals alone, and with nitrogenous manures in addition :—

TABLE XXVII.

MANURES.	SUGAR.	
	Per Cent.	Per Acre.
		Lbs.
Mineral manures alone	9·52	957
Do. and nitrate of soda	7·18	2740
Do. and ammonia salts	8·18	2487

The figures given are the averages of four years—1877-80. This shows clearly the superiority of nitrate of soda for mangels where no farmyard manure is used; for the produce of sugar per acre is 253 lbs. greater than from ammonia salts. But, as has been already pointed out, mangels grown without farmyard manure form only a small proportion of the whole area under the crop, so this superiority of nitrate of soda is relatively unimportant.

SULPHATE FOR MANGELS IN ROTATION.

These results obtained at Rothamsted are fully confirmed by many other experiments carried out on farms in all parts of the country. For example, in an experiment of the Norfolk Chamber of Agriculture in 1886,* on light loam at Whitlingham, on mangels grown without farm manure, a given quantity of nitrogen as nitrate of soda gave a distinctly greater weight of roots than sulphate of ammonia.

In the same year, the experiments of the Essex Agricultural Society, in which farmyard manure was used, showed an average advantage in weight of roots of only 14 cwt. per acre from the use of nitrate of soda, compared with sulphate of ammonia; and from what has been said about the Rothamsted results, it is probable that the actual feeding value in this case would be in favour of sulphate of ammonia.

A good deal of difference of opinion exists amongst farmers as to whether nitrogenous manures should be applied to mangels with the seed or as a top-dressing later. The experiments of the Essex Agricultural Society referred to above, throw light on the question. Taking the results of strictly comparable plots, we obtain the following averages :—

TABLE XXVIII.

	Nitrogen applied with Seed.			Nitrogen applied in July.		
	Tons	Cwt.	Lbs.	Tons	Cwt.	Lbs.
Average of nitrate of soda plots . . .	24	12	54 ..	25	3	56
Average of sulphate of ammonia plots.	24	17	2 ..	23	11	8

There is not very much difference shown here, except that evidently sulphate of ammonia should be applied at seed time, and not as a top dressing later in the year. Nitrate, on the other hand, was somewhat more effective as a top dressing than when sown with seed.

Judging from the results of experiments, therefore, we may conclude that when farmyard manure is used sulphate of ammonia will yield, on the average, an almost equal weight of roots per acre, compared with the produce of nitrate of soda—particularly if there is also a plentiful supply of phosphates and potash, either in the soil or in the manures used. The feeding value per acre is also probably higher when sulphate of ammonia is employed than with nitrate of soda. Without farmyard manure, nitrate is probably superior to sulphate of ammonia, both in yield per acre and in feeding value.

From 1 to 2 cwt. per acre applied at seed time is a good dressing in practice with farmyard manure, 3 or 4 cwt. of superphosphate, and 2 cwt. of kainite. These quantities are, of course, variable according to soil and other conditions.

(To be continued.)

Belgian Briquettes.—In view of the remarks made by Mr. George Beilby in his Inaugural Address to the Society of Chemical Industry, noticed recently, it may be of interest to give some statistics of briquette manufacture in Belgium. We find that the exports of briquettes in the first five months of the present year were 199,712 tons, compared with 233,892 tons and 215,291 tons in the corresponding periods of 1898 and 1897. In these totals, France figured for 98,572 tons, 104,204 tons, and 100,246 tons respectively; and the United States took 28,243 tons, 31,700 tons, and 22,200 tons.

* "Journal of the Royal Agricultural Society of England," Vol. XXIII., S.S., Part I.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 323.)

AGAIN last week business on the Stock Exchange was kept down to a moderate figure; and the causes operating in that direction were much the same as in the preceding week—viz., the Transvaal outlook and the discount rate. Prices generally were inclined to droop; and Consols led the way down. But certain lines, like Americans and Westralians, advanced materially; and by the close there was a rather better tendency all round. The settlement was attended by no financial difficulties, but was worried by the new Hicks-Beach duties, which come into operation to-day. Money was in good demand, and the market was rather agitated until it found on Thursday that the Bank of England was not going to raise its rate, whereupon the position became easier. Business in the Gas Market was active, although dealings were almost entirely confined to two or three of the leading Companies. The great event of the week was the issue of the report of the Parliamentary Committee which have been sitting on the affairs of The Gaslight and Coke Company. The recommendations of the Committee are open to considerable adverse criticism; but this is not the column to discuss them in. Suffice it here to say that the Committee condemn the management of the "accused Company;" and as soon as their verdict leaked out, Gaslight ordinary began to fall. The opening price was 111½; but this was never touched again. On Wednesday, it was once marked "specially" at 105. But this was too low, and the closing bargain was at 107½. The secured issues were hardly affected, and did not move. South Metropolitan, on the other hand, were boomed by the announcement of another penny off the price, and had a big advance to 143 on Saturday. Commercials were not noticed. The Suburban and Provincial undertakings were quiet and unchanged; but Crystal Palace looked ripe for a rise. Among the Continental Companies, Imperial opened very brisk; but it soon quieted down. European new was a trifle easier. None of the remote undertakings were affected by movements beyond a fall in River Plate debenture. Business in the Water Companies was very quiet, and quite devoid of interest; a slight fall in Southwark ordinary being the only change.

The daily operations were: Business in Gas was rather brisk on Monday, and prices were good, although nothing advanced. On Tuesday, transactions were confined to Gaslight issues, which began to give way; the ordinary falling 1. This state of things continued through Wednesday; Gaslight ordinary receding 3. South Metropolitan rose 1; but European new fell ½. In Water, Southwark ordinary dropped 1. Business was much quieter on Thursday; and prices were better. South Metropolitan rose 1½; but River Plate debenture relapsed 1. Friday's transactions were similar; South Metropolitan again rising 1½. Saturday was quiet and unchanged.

ELECTRIC LIGHTING MEMORANDA.

Passing of the New City Order by the Lords' Committee—The Price of Competition—A War of Rates.

THE House of Lords Committee accepted last week the Bill confirming the Provisional Order for a competitive electricity supply in the City of London. So far as legislation can do it, therefore, the innovation is an accomplished fact. The City of London Company made a last effort to defend their position, explaining, by the mouth of their Engineer, the difficulties and disabilities of their undertaking. The Engineer to the Corporation spoke of the nuisance that will be caused by the cable-laying operations of the new comers. Lord Kelvin was retained to impress the Committee with a sense of the disastrous and exceedingly wasteful effect of competition. He declared that the difficulties of the supply would only be increased by dividing the responsibility between the two Companies. Duplicate expenditure on plant and mains would be necessary; and, in the long run, the public would have to pay for all—either by the two concerns amalgamating or by the Corporation buying up both undertakings. "The public would be ultimately fined and put to considerable expense if two sets of mains and two sets of machinery were brought into operation." To this might have been added the burden of duplicate administration and management. This is, of course, the economic case for a regulated monopoly of the kind. The argument is perfectly familiar. On this occasion, however, it failed. Their Lordships pronounced emphatically in favour of competition. Not only so, they insisted on the addition to the Order of a clause to prevent anything like collusion or combination between the Companies pending the purchase by the Local Authority. That is to say, the competition is to be real and effective so far as Parliament can ensure this condition.

All this only emphasizes what we have already remarked respecting the admitted failure of the Electric Lighting Act to improve upon competition as an influence for procuring the cheapest possible supply of electricity. The tearing up of the City streets for laying a second set of cables while the first are

not half employed, and the cost and friction of rival establishments, are a heavy price to pay for the advantage of competition; yet Parliament thinks the benefit worth the money. The most remarkable point of all in this legalized competition is that it cannot be ordinary commercial competition after all, except in a very few instances. Consumers will have a choice of supplies; but they will not be able to change from one to another at will, as in the case of ordinary trade. And although the manufacturing and distributing plant will be doubled, it will not be duplicated in the street sense of the term. One system will not be able to come to the assistance of the other, in the event of a breakdown. Of course, Lord Kelvin was right in the matter of the principle that a doubled installation must cost more than a single one; but the question that lies at the back of this truth is, upon whom does the extra cost fall? In the case in point, the City of London Company have done their best to show that the extra cost, whatever it is, will not fall upon the public, by making such a reduction in the price of current from the beginning of the present quarter, as they lately swore by all their gods would destroy all hope of a dividend.

As a result of this astonishing "come down" on the part of the City of London Company, the puzzled consumers of electricity within the City area are presented with yet another differential scheme of charges. How many schemes of charging for electricity are actually in operation in the kingdom it would be hard to say. Most of them, however, might be fairly described as "dodges"—honest, of course, but still not a little tricky. The City Company not long ago made a parade of the adoption of the Brighton system which, as we showed some weeks since, is singularly ill-adapted to their situation. The Brighton system, with its premium upon long daily use of the light, is attractive to the householder, the hotel-keeper, and the tradesman who lives over his shop—to anybody, in short, who has it in his power to use a light far into the night if he wants it. On the other hand, the same system is an abomination to the fashionable shop-keeper who closes early, to the banker, the merchant, and to everybody who never wants the light for more than an hour or two a day. Wherever the system is put in force, all the reductions of price are applied to the tail end of the scale. Consequently, the front end customers do not like it. The Charing Cross and Strand Company charge a uniform price, with a substantial reduction for quantity. When brought to close quarters with this way of doing business, the Directors of the City Company promptly abandoned their Brighton scale, and offered their customers the choice of two ways of paying for current. By the new order, consumers can pay 5d. per unit "for any amount up to a number of units equal to the number obtained by dividing the number of watts in the maximum power demanded by 10, and 4d. for all units above this amount;" or, as an alternative, they can pay an all-round price of 4½d. per unit. Under the heading of rates for electric energy for power, heating, and cooking purposes exclusively, the choice is offered of 3d. on the dividing rule, or 2½d. all round. In addition, the Directors announce that they are prepared to offer exceptional terms and lower rates than those mentioned, in cases where they consider they will be justified in doing so. This means a war of rates, pure and simple. The City of London Company are bent on trying to choke off their rivals at all costs; and their new price rule is the first stage of the campaign. It is of importance chiefly as a curious addition to the already numerous varieties of electric lighting charges in vogue; for we doubt whether it will interfere in the smallest degree with the prospects of the intruding Company. People in the City know perfectly well how much value to put upon concessions extorted by fear. The Directors of the City Company appear to be very sparingly endowed with common sense, and now they seem to have lost their heads entirely. It is stated in the notification of the new charges that electricity at 4½d. per unit is equivalent to gas at little more than 2s. per 1000 cubic feet. There is much saving grace in this "little more." It is the analogue of the "bittock" in the traditional Scotch phrase, "a mile and a bittock"—where the "bittock" was understood to be considerably longer than the mile. It is useless to protest against misrepresentation of this kind by electric light sellers. They have always used it as a legitimate aid in their trade, and always will. Consumers know all about the matter by this time, and are not likely to be misled by interested statements.

THE NAPHTHALENE QUESTION AND THE RECOVERY OF BYE-PRODUCTS.

THE paper, of which we publish a translation in another column (p. 308) to-day, on "Gas Purification, with Recovery of Bye-Products" by Dr. Bueb, of Dessau, is suggestive in many respects. With regard to the removal of naphthalene, it is interesting to observe that the process of washing the gas with tar oil, which has proved successful on a limited scale, and is about to be extended, at the Dessau works of the German Continental Gas Company, was considered by the German Patent Office to be the prior invention of Mr. W. Young. This official recognition of the value of Mr. Young's work in connection with the naphthalene question forms an appropriate sequel in our columns to the letter from him which we published last week (*ante*, p. 239). The net cost of removing naphthalene completely from gas was found at Dessau to be only 0·045d. per 1000 cubic feet, which is incomparably lower than the probable cost of Dr. Eitner's process for carburetting gas at the works with solvent naphtha. The question of the relative cost of these processes cannot, however, be regarded as settled until Dr. Eitner's process has been applied on a practical scale, and the actual working cost ascertained. The Dessau experiments would seem to indicate that the process used there is considerably cheaper than the Messrs. Botley's carburation process. To many gas engineers, however, the mere mention of washing the gas with tar oil would suffice to place such a process as Dr. Bueb's outside the category of schemes deserving consideration. They would naturally expect to find the illuminating power of the gas ruined by the use of such a washing process. At Dessau, the solvent affinity of tar oil for benzene and the analogous illuminants of coal gas appears to have been satisfied previously by the addition to the oil of 3 per cent. of benzol. Dr. Bueb states that washing the gas with this mixture of tar oil and benzol did not cause any deterioration in the illuminating value of the gas; and we hope that his statement is supported by the results of rigorous photometric testings.

There is, however, one aspect of the removal of naphthalene from coal gas which deserves more attention than it has received at the hands of those who are engaged in elaborating these processes. There appears a general concensus of opinion that the removal of the naphthalene *per se* will not affect the illuminating power of the gas. This view seems to rest on no more substantial basis than a vague impression that the quantity of naphthalene in purified gas is so small that its value as an illuminant may be ignored. But if we ask what is the average quantity of naphthalene in the gas, and what is the illuminating or enriching value of naphthalene, we shall, in nine cases out of ten, find that those who hold the aforesaid view cannot support it by reference to data. We venture, therefore, to suggest that the subject is a very suitable one for careful research. In order to indicate the nature of the work involved in such a research, we will refer to a few of the rather meagre existing data, which we think justify the suggestion that the subject is not unpromising of valuable results. Dr. Bueb concludes from the results of his washing process that 1000 cubic feet of the gas he dealt with contained about 200 grains of naphthalene. Data which were collected in a series of articles on the "Enrichment of Coal Gas" in the "JOURNAL" in 1897, indicate that naphthalene vapour, volume for volume, has about twice the illuminating value of benzene vapour. As an enriching gas, naphthalene vapour would appear to have an illuminating power of from 1000 to 2000 candles.* The removal of the 200 grains of naphthalene from every 1000 cubic feet of gas would, according to these figures, lower the illuminating power by 0·1 to 0·2 candle. It would, therefore, seem to be a pity to remove more naphthalene from the gas than is absolutely necessary to prevent blockages in the mains. Our data are, however, admittedly inexact and incomplete; and until they have been confirmed and supplemented by the results of new researches, no certain conclusions can be drawn as to the effect of the removal of naphthalene on the illuminating power of gas.

The part of Dr. Bueb's paper which deals with the recovery of cyanides from coal gas, is very interesting. It is curious to note, however, that the recovery process which he puts forward as emanating from work done by Dr. Reichardt and himself on the production of cyanides from beet sugar refuse, is virtually the same as that devised by Rowland, and as that employed by the Gaslight and Coke Company. Dr. Bueb refers to the disastrous effect which the recovery of cyanides by this Company had at one time upon the cyanide market; but he appears to have been under the impression that the process employed by them resembled those devised by Mr. Foulis and Mr. G. P. Lewis. Had he referred to an article which appeared in the "Engineer" and subsequently in the "JOURNAL,"† he would have learnt some of the details of the Beckton process, and have found many of his arguments in favour of the extraction of the cyanogen from the gas before it enters the ordinary scrubbers, set out at length. So far as we can judge from the particulars given by Dr. Bueb, the numerous gas-works at which his cyanogen process is adopted are doing no more than was proposed by Rowland in 1891, and was done at the Beckton Gas-Works in 1895. Perhaps his process differs in some respects from the Beckton process in the manner in which the mud is worked up to marketable products; but he does not go into details on this point. We are, however, rather surprised to gather from his paper that he thinks the prussiate maker would purchase the crude mud or liquor from the gas-works, and undertake the manufacture from it of commercial products. If this is his experience in Germany, we think it indicates greater enterprise on the part of German than of English prussiate manufacturers. If there were ready purchasers of such crude cyanogen liquor in this country, cyanogen extraction would rapidly extend, even to quite small gas-works. As it is, the prospect of having to deal with the heterogeneous compounds of ammonia, cyanogen, and iron which are found in the crude cyanogen liquor, deters many gas managers from taking up cyanogen recovery. They have the alternative of adopting Mr. Foulis's simpler process, which very many have accepted despite statements by Dr. Bueb and others that thereby a part of the cyanogen in the crude gas is lost.

* See "JOURNAL," Vol. LXX., p. 529. † See Vol. LXIX., p. 895.

THE REMUNERATION OF LABOUR.

THE problem of the best way of remunerating labour is one of vast and increasing interest. A bulky volume, and a valuable one, might be compiled upon the various solutions of the problem which have been practised at different times.

The progress of the labourer, from the status of slave to that of contracted wage-earner, is part of the history of human endeavour in the way of emancipation and elevation. All things considered, the great economic discovery of the cash wage was made very early in the history of free labour; the only alteration or improvement introduced in this system within historic time being the reduction of the contract period to a small fraction of the day. If modern Trade Unionism in England is to be taken as embodying the most advanced of wage-earners' opinions upon the way in which labour ought to be remunerated, it will appear that no improvement is possible on a cash wage, fixed in accordance with Trade Society rules. The Trade Union principle has its clearest realization in the Councils of the Unions of unskilled workers, where there is no distinction of ability to confuse the central idea. In these Unions, it is notorious that the cash wage, pure and simple, is the only recognized way of remunerating labour. The Union ideal is that there is nothing worth having but wages in hard cash. No piece-work, no profit-sharing, no premiums on any account, and no stoppages are permitted to interfere with the severe simplicity of the worker's wages. The worker is to be paid the rate of wages decreed by his Union; and the employer is not to attempt to help him to cultivate the habit of thrift, or anything else of the kind. The man must be left to do what he likes with his own money. The Union even will not do anything for him, beyond forcing up the standard rate of wage to the highest possible point. Having organized the trade for this object, and no other, the typical New Union leaves its members to the unfettered exercise of their own discretion in the disposal of their cash. We shall not be misrepresenting the avowed principles (say) of Mr. Thorne, of the Gas Workers' Union, in remarking that the above constitutes his simple programme. "Higher wages" are the aim of the Union; and nothing else counts. Shortened working time, of course, is a form of higher pay.

It is impossible to deny that this simple rule has its recommendations. There are Clubs, and Friendly Societies, and Provident Dispensaries, and Savings Banks enow to enable the working man, if he will, to "put by" for himself. The highest kind of virtue is that which a man displays of his own free will, as when he passes the public-house to go to the Post Office with his savings. There is much to be said for the doctrine that men are not really virtuous at all unless their freedom of action is absolute. He is not necessarily a thrifty workman whose hire is compulsorily docked, before he touches it, of the amount of his so-called saving. The circumstance of his having consented to the arrangement does not improve its character. He reaps superior material advantages from his Shop Club; but he loses the benefit of the moral discipline which he would have to undergo if the whole responsibility lay with himself.

Of course, the general principle that it is good for a man to have the greatest possible responsibility for his own conduct, not excepting the disposal of his earnings, is subject to manifold qualifications in the application. Also, the doctrine that the employer owes nothing to his workpeople but their wages must be interpreted with many refinements on the bare rule. The law provides that the employer shall be liable for many other matters besides wages; and the employer is within his rights in taking these things into account. All this means at bottom that the simple rule of work for wages, wages for work, is neither free from imperfection nor is it adequate in the circumstances of modern labour. If all men were perfect, equal, and free, it would doubtless be the best, as it is already the simplest and easiest way of remunerating labour; but, the facts being what they are, it is defective and often distinctly mischievous. The labourer is not always worthy of his hire, as he should be.

The most obvious means of balancing labour and wages automatically is the piece-work system. Trade Unionism objects to the system in the general way; but there are some handicrafts with which it has become the rule, and Unionism has known how to adapt itself to the condition. In the various branches of the engineering industry, a mixed system of day-work and piece-work has grown up. The gas industry exhibits a considerable variety of practice in the payment of labour. Speaking generally, the larger the establishment the more work is done by the piece. Classification of work becomes easier with the increase of amount; and the separation of jobs is a necessary preliminary to setting a price upon the labour. Piece-work, however, as the system is generally applied, is not always satisfactory. In an article recently published, "Engineering" remarks that piece-work in very many cases fails to fulfil expectations, which is quite true. The initial difficulty lies in valuing the job fairly—making due allowance for the additional effort due to direct self-interest. The workman is afraid to do his best, if the price set is too good, lest it should be cut down. Reasoning on this ground, many shop "lawyers" object to piece-work altogether. The very fact that a wide difference is universally recognized between the amount of work a man can do by the piece, and that which he considers himself bound to do by the day is a condemnation of the latter system; but by the topsy-turvy logic of the Trades Unionists it is supposed to discredit the former.

Perhaps the worst effect of the piece-work system is the obstacle it places in the way of mechanical improvement. This is well seen when the work that is let by the piece is heavy, like discharging coals, or something that has become a matter of routine. The men not only get an idea, as "Engineering" remarks, that a job is worth so much, and that the price must be maintained. It is even worse when they assert the right of doing the work themselves, in the old way, regardless of the possibilities of labour-saving machinery. Men of this way of thinking have only to "organize," and to bring in their powers as voters to support their Trade Union pretensions, to make themselves a great nuisance in certain circumstances. Municipalized gas manufacture knows of this procedure. The gas stoker is far from being reconciled to the "iron man" everywhere. The chief blemish of the piece-work system is that the workman's interest is centred in the amount of his earnings, and has nothing in common with that of the employer.

The system of profit-sharing has been devised to supply this desideratum of a common concern for employers and employed. It is objected, on the other hand, that profit-sharing has peculiar shortcomings of its own. It makes the unworthy share the benefits procured by better men. The rewards are too remote; and it is not always easy to satisfy workmen as to the fairness of the financial policy of the firm. It may be to the interest of a company to pass the dividend for a year or two; while in Government or Municipal work there is no profit to divide. On these grounds, a system has been introduced by Mr. F. A. Halsey, an American machinist, to combine the directness and obviousness of the piece-work system with the protection of the employer's interest, as in profit-sharing. It is called the "premium plan," and consists in allowing a stated time for the execution of a job, with an allowance for all time saved on the estimate. Thus, instead of setting a piece of work to a man, or a gang, at a price, the rate of wages is reckoned up with the time allowance. The total amount arrived at is made known; and for every hour saved the man or the gang are paid, as a premium, a proportion, (say, one-third) of the cost of the hour in wages. The amount of the premium varies with the nature of the work. Suppose it to be a piece of machine-minding. Here, if a job usually takes 12 hours to finish, at 9d. an hour, and a premium man can complete it in 10 hours, he is paid 7*s.* 6d. for his time, *plus* 6d. premium. Thus he earns 8*s.* in 10 hours, instead of 9*s.* in 12 hours. His rate of pay, in fact, is raised to 9·6d. per hour. If it is all hand work, the premium would be higher. In starting a system of this kind, it is wise to be liberal with the standard time; while the premium should be moderate. If this is fixed too low at the outset, it can easily be raised; while, if too high, it could not be lowered without impairing the confidence of the men in their employer's fairness. The time allowance, being largely affected by circumstances, the machinery employed, &c., can be altered as these are improved. The chief recommendation of the plan is that it tends to win the men over to the use of improved machinery. It also offers a splendid advantage where fixed charges are heavy. It is remarked that on day-work any extra effort on the part of the workman benefits the employer only; on piece-work his extra effort benefits the workman only (apart from the gain of the output); while on the premium plan the economy effected is shared between the two parties.

It will be perceived that this suggestion is something like the older device of "task work;" and it also resembles the co-partnership idea as applied at the Thames Iron-Works. It is not suitable for universal application, inasmuch as it implies the possibility of continuous labour. If a man is to do in 10 hours what he previously did in 12 hours, he must obviously have something to do for the balance of time saved. It is plainly susceptible of adaptation to various kinds of labour which it is desired to get out of hand as quickly as possible. Mr. Halsey is, however, fain to confess that, when first introduced to workmen, they do not as a rule take kindly to the idea. The Trade Unions, we may be sure, would oppose it to the utmost where they dared. The men look upon it as the old piece-work under a new name; but where it is fairly tried, it answers very well. At one American works the plan has been in force eight years, and in others over two years, so that it is no fancy device. At any rate, it offers a way of enabling the diligent workman to take more money, without encouraging him in that alternation of feverish activity and deleterious idleness which is the curse of most piece-work payment. Moreover, the results as tabulated by Mr. Halsey show that with this intelligent division of gains, the cost of production goes down as the workman's wages go up. In the cost-price sheet of a single contract, comprising heavy steel pipe work, and occupying a total of 20,000 hours, the gain of time under the premium plan was 57 per cent.; the rate of wages per piece was 25 per cent. lower; and the workmen's earnings were 29 per cent. more than under the old day-work system. This is a notable recommendation.

Institution of Mechanical Engineers.—The summer meeting of this Institution was held at Plymouth last week. Among the papers read was one by Mr. E. Sandeman, on "The Outlet Valves at the Burrator Reservoir of the Plymouth Water-Works." Mr. W. Ingham sent a paper on "The Incrustation of Pipes at the Torquay Water-Works;" but its reading was postponed.

THE LAST EXAMINATIONS IN GAS MANUFACTURE.

In the two preceding issues of the "JOURNAL," we have given lists of the successful candidates and prize winners at the last examinations in "Gas Manufacture" conducted by the City and Guilds of London Institute. In connection with these annual examinations, it is gratifying to notice the continued success of the students at the Polytechnic Institute, Regent Street, where the classes are conducted by Mr. Walter Grafton, F.C.S.; for out of 81 passes, 22 were Polytechnic students. This success is in a large measure due to the skill of the teacher, who not only possesses all the knowledge required for his position, but has the gift of imparting it to his pupils, and, moreover, of likewise gaining their personal esteem. The winner of the first prize at the City and Guilds Examination—Mr. H. D. Madden—secured the first prize in the Honours grade (a silver medal and a certificate) at the Polytechnic; Mr. W. H. Johns, who gained a second-class Honours certificate, took the Polytechnic second Honours prize (a book of the value of 10s. and a certificate); while Mr. G. L. Jennings, who also secured a second-class Honours certificate at South Kensington, gained the third Honours prize (a 5s. book and a certificate) at the Polytechnic. In the Ordinary grade, the winner of the bronze medal at the City and Guilds examination—Mr. D. J. Winslow—gained the London County Council scholarship of £5, tenable for three years, and a certificate, as well as the first prize (a bronze medal and a certificate) at the Polytechnic; Mr. A. F. Ball, who passed first class at South Kensington, took the second prize (a 10s. book and a certificate) at the Polytechnic; Mr. P. F. Scarth, who passed second class, gained the third prize at the Polytechnic (a 5s. book and a certificate); and Mr. A. Mead, who also passed second class, secured a London County Council scholarship of £5 and a certificate. The prizes were presented last Wednesday evening; and much gratification was expressed by the students at the results of their work—a very natural feeling, seeing that the City and Guilds silver medal in the Honours grade and the only two County Council scholarships have been secured by three of their number, apart from the other results. Mr. Madden had quite an ovation when he went up to receive his Polytechnic silver medal.

It may be interesting to mention that Mr. Madden, Mr. Ball, Mr. Mead, and Mr. Winslow are engaged in the distributing department of The Gaslight and Coke Company, as are also Mr. A. Mason, who passed first class in the Ordinary grade, and Messrs. R. P. Audley, G. H. Lloyd, and W. T. Page, who passed second-class. Mr. F. W. Goodenough, who gained the second prize in that grade, is engaged at the chief office. It is therefore very creditable to the younger members of this Company's staff that, out of a total of 81 successful candidates, as many as nine have found places in the list, and further that three out of the five prizes awarded by the City and Guilds of London Institute for papers of special merit have been gained by them. We heartily congratulate these young men upon their success, and the Company upon having at their command such promising material.

We gave in the "JOURNAL" for May 2 last the question-papers prepared by Mr. A. Colson for the City and Guilds examinations. We now reproduce the papers set in the Honours grade at the Polytechnic and for the London County Council's scholarships:—

Polytechnic Paper.

1.—Wherein lies the essential difference between generator settings and direct-fired settings; and which, in your opinion, is the most economical?

2.—What is carburetted water gas? Give a sketch of a water-gas plant, and state the objections to the use of this gas.

3.—Describe two methods of incandescent gas lighting, and state what advantages are gained over flat-flame lighting.

4.—Give sketches, plan, and section of a purifier. What size of connection should be used for purifiers 20 by 20 ft., having five layers of lime?

5.—Give the percentage composition by volume of a typical purified coal gas and carburetted water gas.

6.—Give your reasons for and against the construction of (a) a puddled gasholder tank and (b) a rendered tank.

7.—In what way can CO_2, SH_2, and CS_2 be determined quantitatively? State the names of the instruments used.

8.—State the advantages and disadvantages of inclined retorts, and describe briefly such a setting of retorts.

9.—Name two kinds of coal most generally employed in a gas-works, giving the proportions of the products obtainable per ton from each.

10.—Describe and illustrate by sketches a sulphate of ammonia saturator, and state what quantity of crystals are usually obtainable per ton of coal carbonized by it, having regard to the quantity of the acid used.

London County Council Scholarships Paper.

1.—Give a short account of the different kinds of coal, and state the distinguishing features of each kind.

2.—Draw and describe some good form of gas-retort.

3.—How would you determine the calorific value of a sample of coal?

4.—What is the average composition of coal gas? Describe the various constituents with regard to their heating and illuminating properties.

5.—How would you estimate the illuminating value of a sample of coal gas?

6.—How would you perform a quantitative analysis of a mixture containing carbonic acid, carbon monoxide, hydrogen, marsh gas, and ethylene?

7.—Draw and describe some good form of scrubber, and explain its action.

8.—Describe a suitable form of instrument for measuring the amount of gas supplied to a house.

9.—Give an account of the manufacture of water gas, and compare its properties with those of coal gas.

SELF-IGNITION, FAR AND NEAR.

The self-igniter is proving itself to be something more than an interesting new toy, which some folks, just for the sake of its novelty, may adopt one day and discard the next. Time was when we ourselves were a little sceptical as to its enduring usefulness and qualities; but a longer acquaintance, new improvements, and wider applications have produced a greater faith in it. Without impugning in any way the merits which other gas lighters of this class are said to possess, we may freely say that with the Matchless Gas Lighting Syndicate, Limited, rests the credit of having been the first to take effective steps for developing this system of gas ignition in this country. And what is more, they have not remained content with the igniter—efficient though it was in its action—as originally introduced to the public at the Holborn Restaurant in the autumn of last year;* but they have since been applying themselves to its simplification (which means a cheaper article), and to demonstrating its applicability to gas lighting under divers conditions and in all sorts of situations.

One of the most interesting of the installations lately made is at the Waterloo Station of the South-Western Railway. There the large Sugg lanterns on No. 2 platform have been fitted with the igniters. In all eighteen lanterns have been dealt with—thirteen on one service, and five on another; but, for the purpose of this article, it will suffice to refer only to the former. Of the thirteen lanterns, ten contain tripod burners, and three duplex ones. Each lantern is supplied with one of the Syndicate's igniters on the automatic principle, so arranged that they are not affected by any air contained in the service-pipes, which air finds outlet at the burners. This question of the air contained in considerable lengths of service-pipes is one which gas engineers have assumed would be a difficulty in applying the system to a long stretch of gas-lamps, and controlling them from one point. It was fancied that the air might retard the action of the igniter, with perhaps unpleasant consequences. But in the installation at Waterloo Station, we have, so far as ordinary burners are concerned, proof to the contrary. One day last week, accompanied by the Engineer of the Syndicate, Mr. W. J. Hicks (in which name will be recognized the late Manager of the Ascot Gas Company), we visited the station, in order to test for ourselves exactly what the Syndicate were able to accomplish in this way. It was found that altogether the length of service-pipe from which the thirteen lanterns lighting No. 2 platform are suspended is about 300 yards; that it is composed of 1¼ to 1½ inch tubing; and that the whole service is controlled by a 1½-inch Carter valve on No. 1 platform. This was in the daytime, so that the pipes had not been in use for some time previously, and would consequently be well charged with air. At a given signal, the attendant turned on the valve, and in ten seconds the whole of the thirteen lights were doing full duty. Never in the course of our experience have we seen thirteen, or any other number of electric arc lamps come into operation so quickly and with such little fuss. The objectionable hissing, spluttering, and violent fluctuations which occur with electric arc lamps are entirely absent; and silently and almost instantaneouly, to the wonderment of those who are not "in the know," the gas-lamps are brought into action. Of course, the number of lamps which may be controlled by one valve may be extended to any reasonable extent. There is one point which it is only right should be alluded to; and it is this, that in the case of a number of incandescent lights controlled by one valve, the ignition would not be quite so rapid, as the air in the pipes would not have such a free egress as is provided by these large open burners. To overcome this little drawback, however, the Syndicate are trying to design a valve for the purpose of releasing the air independently of the burners; but, in the meanwhile, the trouble could no doubt be averted by fitting the end lamp on a length of service with ordinary burners which would permit the free escape of the air.

It may be added that some of the igniters at Waterloo Station have been in use about two months; but the majority have been brought into service within the last three weeks. In reply to inquiries, the Railway Company's lamp attendant stated that he has experienced no difficulty with them, and that in their action they have been all that could be desired. They were fitted by the Railway Company's own men; and subsequently, to ensure success, Mr. Hicks simply looked to the adjustment of the platinum pill. It is anticipated that they will run for about twelve months, without the renewal of the pill, provided no adventitious mishap occurs. The vibration caused by the trains has not affected the adjustment in the slightest degree. It may be that they will require occasional attention; but this will be more than compensated for by the saving of time, labour, and gas which must result from the facility of lighting up and extinguishing these highly-placed lamps. And, moreover, during the busy evening hours, passengers will not be worried with the "By your leave" of the lamplighter and the obstruction which that hitherto necessary official has at times unavoidably caused in performing his duties. In the case, too, of small country railway stations where the coming and going of trains are an infrequent occurrence, and the price of gas is dear, the advantage of self-igniters would be represented in a year by a very appreciable monetary saving. In connection with railway

* See "JOURNAL," Vol. LXXII., p. 864.

lighting, another novel application of the igniters may be mentioned—that is, in the maintenance of the signal-lights in tunnels. Experience has shown that the violent draughts caused by the passage of express trains through tunnels will ofttimes extinguish these signal-lights; but the self-igniter has furnished the means of meeting such a contingency, and its employment for the purpose promises considerable extension.

Having given these illustrations of the success of the igniter in lamps fixed at a distance from the controlling point and in elevated positions, there are two or three improvements which the Syndicate have introduced to which attention may here be directed. One is a very sensible modification in the construction of the igniter for ordinary purposes—for both common and incandescent burners, in street and domestic lighting. It is the substitution of a two-way lever cock or tap for the automatic mechanism. With the new arrangement, to produce the incandescence of the platinum pellet, the tap is turned completely over to the right, and then immediately brought back to a central position, on which the jet of gas ignites. The action is so quickly performed that the half return movement is scarcely perceptible, and the lighting is almost instantaneous. The only difference between the new igniters for ordinary and incandescent lighting is that those supplied for the latter have longer stems for supporting the lighting medium than those required for the former. The advantages of the new type of igniter may be summed up thus: There is no automatic mechanism to get out of order, and the only part that can perish is the platinum pellet, which, however, with fair usage, will last twelve months, and can be renewed for a few pence. Then the ignition is quicker with the two-way tap than with the automatic mechanism; and further the lighter can be produced at less cost, and consequently sold at the reduced figure of 2s. 6d. For situations where the igniting medium is exposed to danger, the Syndicate have also devised a neat little guard. At their offices, they also show an ingenious application of the igniters to chandeliers; and the arrangement is, of course, applicable to other pendant lights. At the top of the chandelier is a spring lever, operated by a fine cord, which can be carried to any convenient part of a room. By drawing the cord downwards, and attaching it to a hook, all the lights are put into operation; and by simply releasing the cord again, they are instantly extinguished. To some readers these may appear trifling matters; but it is knowledge of these small points which the gas manager finds useful in meeting the competition of the electric light when arguments as to its ease and convenience are thrown in his face.

TAXED COSTS.

THE difference between the costs actually incurred by a successful litigant and what he is able to recover from an unsuccessful party ordered to pay them, is notoriously great, and, while always unjust, is often the source of very real hardship to the comparatively poor suitor. This difference is, as many readers are doubtless painfully aware, the amount struck off the bills of costs by the Taxing Master in respect of such expenditure as he may deem to have been unnecessarily incurred. From the interpretation placed by the Taxing Masters upon the word "unnecessarily," one would infer that they themselves have never had occasion to sue on their own behalf.

The scandal of a suitor being perhaps hundreds of pounds out of pocket, although, having completely won the day, he has been awarded his costs—on the ground that the action, if brought against him, was unjustified and vexatious, or, if brought by him, ought not to have been necessary—was the subject of a report of the Incorporated Law Society so far back as December, 1892. This report recommended that the costs to be allowed should be "all those which have been reasonably incurred by the clients." As, however, the Taxing Masters, though no one else, considered that they already allowed all reasonable costs, and no action was taken to give definite effect to this recommendation, it was of no effect. The question has, we are glad to see, now been taken up, and a report issued thereon, by the General Council of the Bar; and their recommendations, endorsing and amplifying those made by the Incorporated Law Society, will, if they are adopted, and given practical effect to, do much to remove the injustice. The Council state that there has been, for a considerable time, an impression prevalent that the taxation of costs is regulated by scales which are more favourable to the practitioner in the Chancery Division than they are in the Queen's Bench Division, but that their investigations have satisfied them that this impression is without foundation. There is, however, they find, a considerable difference in the methods of taxation in the two divisions, especially in the exercise of discretion with respect to the amount of the allowances. The Chancery Taxing Masters exercise a wider discretion than do the Queen's Bench Masters; and the Council "are of opinion that a grievance exists in the way in which the latter disallow and reduce items which ought fairly to be allowed as charged. . . . In any important matter, the successful litigant fails to recover from his opponent a heavy proportion of what are usually the most serious items of his bill of costs—viz., fees to Counsel, instructions for brief, and payments to witnesses."

The Council therefore recommend that the principle should be laid down that in litigious matters the party awarded costs "should be indemnified in respect of all expenses reasonably and properly incurred, and should be left to bear only such costs as have been due to special expenditure or over-caution, negligence, or the mistake of himself or his advisers. They further think that this rule should be applied to all proceedings in all Divisions of the Supreme Court." This principle has been to some extent recognized in the Public Authorities Act, 1893, in cases in which Public Authorities are defendants. The Council consider that there exists no "sound reason for any distinction between cases in which they are plaintiffs and those in which they are defendants, nor any reason why they should be placed in a better position as regards costs than their adversaries, particularly where, as not unfrequently happens, their conduct is of an arbitrary character." The principle sought to be established commends itself as obvious common-sense and justice, and will, we hope, be speedily acted upon. We are confident that all gas managers who have ever—and who is so fortunate as not to have had?—occasion to cross swords with Public Authorities in the Supreme Courts, will heartily wish "more power to the elbow" of the General Council of the Bar.

PERSONAL.

Mr. W. ORME, of Congleton, has resigned the management of the gas-works to take up similar duties at Wirksworth.

The Edinburgh and Leith Gas Commissioners have advanced the salary of Mr. W. R. HERRING, their Engineer, by £300 per annum, with the right, at the expiration of the lease, if not before, to occupy Granton House and grounds free of rates and taxes.

By an announcement which appears in another part of the "JOURNAL," it will be seen that the managership of the Mossley Corporation Gas-Works will shortly be vacant. The cause of this is the appointment of Mr. F. W. JOHNSTON, the present Manager, as Resident Superintendent of the Swan Village station of the Birmingham Corporation, in succession to Mr. Richmond, who, as mentioned last week, is going to Saltley.

OBITUARY.

The death recently occurred of Mr. JOHN LEA, the senior Director of the Cheltenham Gas Company. He was in his 83rd year.

We regret to learn of the recent death, at Thorn Hill, Stourbridge, of Mr. GEORGE PEARSON, of the firm of Messrs. Harris and Pearson. Deceased was in his 78th year.

The death of Mr. FREDERICK FLINT, J.P., of Roper House, St. Dunstan's, Canterbury, occurred on the 23rd ult., in his 90th year. Deceased was for thirty years a Director of the Canterbury Gas and Water Company, and for some time held the position of Vice-Chairman.

The death is announced of Mr. HENRY SIMON, of Manchester, whose name is widely known in connection with the Simon-Carvès coke-oven. We learn from the "Engineer" that Mr. Simon was born in Brieg, in Silesia, in 1835. He obtained the "engineering" degree at the Swiss Federal Technical College in 1859, commenced business in Germany, and finally came to England and settled in Manchester in 1860. It was in a paper read before the Iron and Steel Institute that he called attention to the usefulness of the Carvès oven, in which he had effected improvements, in the recovery of bye-products and the production of sulphate of ammonia; and the invention was first applied on a large scale at the extensive collieries of Messrs. Pease Bros., in Durham. An important installation of the system, erected at Lanchester by the Durham Coke and Bye-Products Company, Limited, of which Mr. Simon was Chairman, was described and illustrated in the "JOURNAL" for Dec. 31, 1895. He was known to many of our readers in connection with the Grüneberg still for the manufacture of sulphate of ammonia, for which he was agent. Mr. Simon was a member of several scientific institutions, and was greatly interested in educational matters. A few years ago, he endowed a professorship of German literature at Owens College, Manchester. He was in his 65th year at the time of his death, which took place at "Lawnhurst," Didsbury, on the 22nd ult.

The London County Council and the Gas Inquiry.—The Parliamentary Committee of the London County Council, in the course of a long report on the *agenda* for to-day's meeting, deal with the report of the Select Committee on the Powers of Charge of the Metropolitan Gas Companies, which appears in another part of the "JOURNAL." The Committee indicate the points which the evidence given on behalf of the Council by the Comptroller (Mr. H. E. Haward) and Mr. Charles Hunt was chiefly directed to establish; and they say the recommendations of the Committee endorse the advice the Council have received from Mr. Haward from time to time. The Parliamentary Committee have not had time to fully consider these recommendations; and the matter will have further attention during the recess. In the meantime they say that, in their opinion, the action of the House of Lords in rejecting the Company's Bill, in view of the inquiry then being in progress, has been justified by the report.

NOTES.

Professor Kennedy on Tramway Traction.

The latest professional criticism of combined electric traction systems is contained in Professor Kennedy's report on the subject to the Corporation of Newcastle-upon-Tyne. Like many other city governments of the United Kingdom, the Newcastle City Council are willing to put up with the overhead trolley-wire system of working tramways electrically, for the outlying districts. They do not, however, see their way to carrying the system into the congested centre of the city; and they asked Professor Kennedy to say how electric traction could be adapted to the whole of the local conditions. The most obvious combination for this purpose is that in which accumulators serve to bridge over the gaps of the overhead wires. Professor Kennedy confesses that, although the arrangement appears to work well in some level places, he does not know what it costs, and is certain that the accumulators would not do for the steep streets of Newcastle. There remain surface-contact systems, and underground conduit systems. The former are attractive; but there has not been much experience with them. The latter are quite practicable, in several patterns. They do not cost more for maintenance than an overhead system; but in cost of construction they must exceed any ordinary overhead line, and they may cost very much more if any considerable difficulties exist as to underground pipes within a few feet of the surface. Moreover, these systems necessitate a split or slot rail.

The Effect of Sugar on the Fixation of Nitrogen by Plants.

Some remarkable observations on the fixation of atmospheric nitrogen by plants have been communicated to the Nottingham Section of the Society of Chemical Industry by Mr. John Golding. These statements refer to the action of the nitrifying organisms whose powers in this respect seem to be so uncertain. Mr. Golding has found that the nitrifying organisms cannot act without the co-operation of other organisms capable of abstracting the oxygen from the air, and supplying a suitable carbohydrate to give the energy necessary for fixation. Following up this indication, it has been found that the presence of sugar greatly aids the fixation of nitrogen. Up to the present time, the fixation of atmospheric nitrogen in soils is known to be most certainly and rapidly effected by the action of the micro-organisms of the root nodules of leguminous plants. Hitherto, however, although much work has been done upon this subject, it has not been settled what part the plant itself plays in the process. Mazé's researches go to show that the supply of sugar is the chief, if not the only, function of the plant in this respect. Mr. Golding has endeavoured to experimentally test this idea by a series of pot-cultures, with the result of showing that sugar added without nitrogenous manure produced a marked increase of growth. The general conclusion is that, although sugar and other carbo-hydrates are likely to be too expensive for the ordinary agriculturist to use as dressing, yet the demand for forced vegetables, fruit, and flowers is considerable enough to make any substance valuable which enables plants under glass to ripen with a minimum of sunlight.

Fire-Proof Construction.

The modern system of fire-proof building construction, in which so much use is made of coke breeze concrete, is very properly being subjected to frequent fire tests, in order to determine the weak points of different varieties of the system. In a Franklin Institute paper on the subject, Professor W. H. Burr remarks that there is a great future before concrete construction reinforced by built-in iron or steel rods, wires, or network. He regards this combination, of which the Monier system is an example, as offering a mass of great resisting capacity, which at the same time lends itself readily to many structural demands, and thinks "we are but just beginning to realize what a valuable structural material we have in concrete," especially when reinforced. Mr. W. Copeland Furber also holds that portland cement, combined with a wire mesh, is practically indestructible under the conditions of a local fire. Meanwhile, the tests of the British Fire Prevention Committee show that concrete flooring possesses a high resistance, provided that the surfaces of the steel joists can be kept covered. A curious result of a recent test by the Committee showed that in the case of two partitions, one of wood-lathing covered with plaster, and the other of wire-lathing similarly covered, both were destroyed. The former lasted 25 minutes from the commencement of the fire, and the latter 40 minutes. In 25 minutes the wire-lathing on the side next the fire was bare of plaster and the wire nearly all down. This perishability of the wire-lathing was not what one would have expected; but the record shows how untrustworthy so called incombustible building materials may prove in use.

Mr. W. Thomson on Oil-Lamp Explosions.

Mr. W. Thomson, of Manchester, has continued his experimental investigation of the phenomena of explosion in mineral oil lamps, and has communicated the results to the Manchester Section of the Society of Chemical Industry. He confesses that he has never been able to make a petroleum lamp explode; but he believes that veritable explosions do occur when the necessary conditions are realized. Although this is so difficult that the coincidence of all the factors cannot be expected more than once in ten million times during which a lamp is burning, yet it is bound to happen sometimes. Mr. Thomson obtained forty burners of lamps that were alleged to have exploded; and fifteen samples of the oil used in them. Of the latter, two had a flash-point of 75°, which was the lowest. The highest flash-point was 89°. Roughly speaking, four of the fifteen oils were of the American kerosene type, flashing at under 80°, and the rest were of the Russian type. Not one had a flash-point nearer than 11° to the 100° London Petroleum Committee standard. Upon the facts before him, Mr. Thomson finds that the high-flash Russian oils are probably four times more dangerous than the low-flash American oils, since the conditions of temperature of the room and the lamp are such as to give more often the mixture of oil vapour and air requisite to produce an explosion. Consequently, Mr. Thomson thinks that the proposed new standard flash-point of 85° or 86°, obtained by splitting the difference between the contending standards of 73° and 100°, would be a change for the worse from the existing standard. Taking all considerations into account, Mr. Thomson concludes that the standard flash-point of lamp oil should not be lower than 100°, Abel close test. A resolution to this effect was passed by the Section.

Laying Main Pipes Under Water.

A detailed account of various methods that have been successfully adopted for laying pipes under water was recently published in the "Engineering Record." A large number of submerged pipe lines have been laid from platforms or trestles. Sometimes the ordinary socket and spigot joints are used; and the whole stretch of main is slung and lowered by means of screws. In other cases, joints capable of taking a bend are employed, and the main is lowered gradually, as the work proceeds, on a raft or scaffolding. Some American streams crossed by mains are very deep and swift. At Port Huron (Michigan) a 20-inch water-main crosses a navigable river 390 feet wide and 20 feet deep. At Great Falls (Montana) a 10-inch water-main crosses the Missouri where the current is very swift. Here globular joints—every eight lengths were used, and the end of the pipe was always out of the water. At another Missouri crossing the joints were made up on shore, and the main as put together was buoyed with empty oil-barrels, and dragged across the stream by a windlass on the far side. The same expedient was resorted to some years ago at Liverpool, in order to carry a temporary 12-inch riveted steel main over the Mersey. In another case the main was supported on a split raft of oil-casks, carrying trestles from which the pipe was hung by tackle. A big job was the laying of a double line of 60-inch intake water pipes to a distance of 8000 feet into Lake Michigan, at Milwaukee. The pipes were put together with lead joints on shore in lengths of 50 feet. A false socket was formed by a hinged ring casting, slipped over the spigot end of the last pipe. The lead was run into this, and the false ring was then removed; the lead remaining in place. As the sections were lowered under water, divers received them, put them together by clamps, and calked the lead. The method of jointing is, of course, the principal subject of anxiety in this kind of work. The Ward flexible joint is frequently mentioned in the American records.

The Flow of Water Through Valves.

An important paper on the flow of water through valves was presented at the last meeting of the the American Water-Works Association by Professor W. T. Magruder, head of the department of mechanical engineering of the Ohio State University. The author remarks on the obvious obstructions and contractions existing in valves and cocks of the ordinary patterns. In the case of what are called globe valves—that is, those in which the stop descends vertically upon a seat bored out to receive it—there are no less than eleven places where loss of head must arise. In so-called straightway, or gate valves, hydraulic losses occur at six or seven places. Professor Magruder remarks that in general the area of the valve opening is never so large as the actual bore of the pipe connected with it. In screw-down valves, the disc not only does not lift high enough to give a free passage, but the nut of the valve-spindle also hangs down like a uvula in the throat of the water-way. The subject of losses of head through valves was set for a graduating thesis at the Ohio University in 1897, and was taken up by Messrs. Damron and Judd, who worked it out with great patience and skill. They tested five sizes of seven makes of valves, each at six different pressures. The investigation was made in the hydraulic laboratory of the department of mechanical engineering at the Ohio State University; and the fact of the research having been so conducted shows the benefit to be derived by students at technical instruction centres of this kind. A standard of valve efficiency was assumed, this being the theoretic rate of flow through a frictionless pipe of an area equal to the actual dimension of the pipe, at the known head of water. The ratio of valve efficiency was that of the actual as compared with the standard rate of flow. It was found that a rough test of the efficiency of a valve is the fall of pressure from the stand-pipe to the valve. In other words, of two valves disc harging water from a stand-pipe at constant pressure, the one having the greater efficiency will have the least pressure at the valve. It is indicated that in good practice, water-valves at least one size larger than the nominal size of the wrought-iron pipe should be used. As a rule also, the higher-priced valves were found to pass more water than the cheap makes.

TECHNICAL RECORD.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting at Stirling.

The Thirty-Eighth Annual General Meeting of the above-named Association was held in the Albert Hall, Stirling, last Thursday. There was an attendance which was probably the largest witnessed at any meeting of the Association, which was most probably due to the fact that there was to be an exhibition —for the first time out of London—of Keith's automatic air and gas compressors; the programme being otherwise an extremely light one. Mr. HUBERT POOLEY, of Dunfermline, the President for the year, occupied the chair.

WELCOME TO THE TOWN.

The PRESIDENT said they had with them Mr. W. Johnstone, the Chairman of the Stirling Gaslight Company, to whom they must give a hearty welcome, as the kindness of the Company to them had been very great.

Mr. JOHNSTONE said he was glad to meet the Association, and wished to be allowed to say, in the name of the Stirling Gas Company, that they were much gratified that the Association should see fit to visit Stirling again. Since their last meeting there, the Company had passed through some anxious experiences; and had the Association come there a year or two ago, he was not sure that they might not have looked upon them with some suspicion. But they were now in a position of confidence, and they heartily welcomed them to the Royal Burgh; and instead of closing their gates against them, they invited them to go and see their works. The place had been in a transitionary state for the last two years, and therefore they had not yet works free from some confusion; but they would be very pleased to show their visitors everything, so that they would not have to take a peep into the works from the outside. If anyone had any suggestions to make, they would be thankfully received and carefully considered. He had had an opportunity, the previous day, of seeing Mr. Keith's process of intensifying gas, and he believed that, where it could be conveniently applied, electric light would not compare with it, either for brilliancy or for cheapness. He considered it would be very much of a prize to them. He hoped that the meeting would be both pleasant and profitable, and that all their arrangements would terminate successfully.

THE COMMITTEE'S REPORT.

The SECRETARY (Mr. R. S. Carlow, of Arbroath) read the report of the Committee. It set forth that the benevolent fund in connection with the Association had been drawn upon to the extent of £23 in the past year; three sums having been paid to two deserving cases. The sum of £11 12s. 10d., being the balance at the credit of the Murdoch Memorial Fund, which was handed to the Secretary at the last annual meeting, had, by instructions of the General Committee, been placed to the credit of the research fund. The Murdoch Memorial Fund account was now closed. The correspondence during the year with the Council of the Gas Institute upon the subject of the standardizing of meter-unions was next given, concluding with the return of the set of standards the Association had lent, and which the Council had examined with great interest. The report then proceeded as follows:—

> This letter was fully discussed, and, after consideration, the Secretary was instructed to call the next Committee meeting in Edinburgh, and to invite the Edinburgh meter makers to be present at that meeting, in order that the Secretary of the Gas Institute's letter might be fully discussed with the Committee of this Association, and an understanding arrived at, and a joint report drafted for submission to the annual meeting. On July 5, 1899, your Committee met in Edinburgh, and the meter makers were all invited to attend the meeting. All the meter makers in Edinburgh sent representatives to the meeting. The position of matters was fully discussed between the meter makers and the Committee of the Association, when the following finding was arrived at: "As the result of a discussion of the question of standard unions, it was deemed inadvisable to further press the question of the adoption of the standard meter-unions provisionally approved; but, with the view of removing the practical difficulties arising from slight variations in the pitch or diameter of screws now in use throughout Scotland, the meter makers undertook to institute a careful comparison between the unions presently in use, and mutually adjust, if possible, such difference as may exist, so as to ensure that the unions of the various makers be uniform and interchangeable."

The report concluded by stating that the Committee unanimously recommended that the name of Mr. Peter Watson, late of the Stirling Gas-Works, be added to the list of honorary members, as he had been for so many years connected with the Association.

On the motion of Mr. T. WILSON (Coatbridge), seconded by Mr. W. EWING (Hamilton), the report was unanimously adopted.

Mr. P. WATSON briefly thanked the members for electing him an honorary member of the Association.

NEW MEMBERS.

The following were admitted to the Association:—

Ordinary Members.—Angus, J., Wigtown; Blair, P., Haddington; Forrest, R., Birnam; Galloway, J., East Wemyss; Keillor, G., jun., Peterhead; M'Donald, J., Aberlour; Smith, A., Airdrie; Smith, J. D., Stirling; Watson, P. B., Stranraer.

Extraordinary Members.—Hamilton, A. H., Glasgow; Marks, T., Glasgow; Munn, A., Glasgow; M'Kenzie, A., Edinburgh; Peebles, W. C., Edinburgh.

Associate.—Dickson, J. Forfar.

Honorary Member.—Watson, P., Stirling.

THE ANNUAL ACCOUNTS.

Mr. R. B. MAIN (Glasgow) the Auditor, submitted the accounts of the Association for the year. They showed the following sums: General Fund, £153 12s. 9d.; Benevolent Fund, £259 10s. 3d.; Research Fund, £100 0s. 2d.; and Excursion Fund, £111 19s. 2d. There were also the following cash balances: General Fund, £50 14s. 7d., Benevolent Fund, £226 1s. 8d., Research Fund, £30 18s. 2d., and Excursion Fund £20 6s. 2d. Mr. Main said the members had been furnished with copies, and the statement might be taken as read. He should like just to state that the funds were in a very satisfactory condition—in fact, he did not think he had ever been able to submit such a very good report for many years. He thought the thanks of the Association were due to Mr. Carlow for the excellent way in which the accounts were kept.

The accounts were approved.

The PRESIDENT said they should not permit this subject to pass without giving a vote of thanks to Mr. Main.

Mr. MAIN briefly returned thanks.

THE PRESIDENT'S ADDRESS.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—My first duty to-day must be to thank you very heartily for the honour you conferred upon me by electing me your President at the last meeting. It is six years since I joined the Association as a stranger from over the Border; and I must say that from the members of the Association in the North I have received nothing but kindness. I am one of the younger members of the Association, and of the profession; and in addressing you to-day I do so with considerable diffidence—mainly owing to the fact that I have, unfortunately, to follow the exceedingly able addresses very recently delivered before The Gas Institute and the Institution of Gas Engineers. The technical press has made us all familiar with them. I must, therefore, crave your indulgence, and ask you to kindly bear with me.

We have now had a full year's experience under the Workmen's Compensation Act; and, so far, it would seem to have principally benefited the Insurance Companies. This questionable benefit has directly resulted in a great increase of rates. For example, the rates at Dunfermline, which were formerly 2s. per cent. on the wages paid, were at once sent up to 9s. per cent. Latterly, in some directions at any rate, insurance people seem inclined to modify their views on the subject considerably; and I have recently had a quotation of 5s. per cent. from one of the leading offices.

Growth and progress have of late years, happily, entered into almost every phase of our national commercial life; and the industry in which we are all so much interested, has during the past year naturally shared in this prosperity. In comparing our latest gas statistics with those of the previous year, I find that the gross increase at Scottish gas-works has amounted to about 343 million cubic feet of gas. But while our makes have increased, coals have been dearer; and those of us who have not already purchased, will find that they are to be much dearer still. This is a penalty which, in common with other manufacturers, we have to pay for a widening area of prosperity. We are all likely to benefit from the increased price of residual products. Coke commands a good price, and has a ready sale; and, with the present good price of sulphate of ammonia, tar and liquor should show an improved return.

The relations between capital and labour have, for the most part, been amicable; and concessions have been given to the working man in many cases.

Competition with our friends, the electricians, still continues; but I am glad to say gas more than holds its own. There have been several cases where the old snuffed-out gas has been reinstated, and the newer light displaced; one notable case being that of Sandringham, the Prince of Wales's residence in Norfolk. The development and practical application of "intensified gaslight" has put into our hands a cheaper means of obtaining a better light than anything which has yet been brought out electrically, in the way of either arc or incandescent electric lighting; and we shall have shown to us, later on in the day, a practical illustration of a type of plant for obtaining this magnificent light. This light will lend itself principally to the lighting of large interiors or open spaces, and for street lighting. Examples of incandescent street lighting by the ordinary burner are familiar to all of us. In Dunfermline, there are in use some 54 burners, which, during the year, cost for repairs the sum of £19 16s., equal to 7s. 4d. per lamp. They required 250 mantles, 15 globes, 154 rods, and 2 small inside globes. The average gas consumption in these lamps for the year was 8800 cubic feet in the "all-night" lamps, and 2150 cubic feet in the "half-night" lamps.

With regard to the lighting of factories and other similar

undertakings where the rapidity of the moving machinery is liable to set up continuous excessive vibration, it has been clearly proved that incandescent lighting can be adapted to such conditions. I have had one striking case in my own town. Since the Corporation took steps to acquire the gas undertaking in 1896, there had been talk of introducing the electric light into one of the linen factories; and, as I was naturally anxious to show the proprietors of the factory something of the possibilities of gas, I made efforts to place a few experimental incandescent burners, but only succeeded in getting them into the offices. At length a firm manufacturing anti-vibration apparatus took the matter up, and succeeded in placing some fifty burners in the power-loom factory. Vibration on the gas-fittings was very heavy and continuous; and I confess I had some misgivings as to the ultimate success of the experiment. Ten weeks after the fixing of the burners, on calling at the factory, I found that up to that time they had not needed to renew a single mantle. The result to the consumer was a saving of fully 27 per cent. in the gas bill for the year, although the factory was only partially lighted by the incandescent system, and that for only part of the season. I have no doubt that next season we shall have the whole of the buildings lighted in this way, and there will be no further mention of electricity.

Another of our competitors, acetylene, has found great favour in some directions; but most of those who have adopted it as a means of public lighting have learned a bitter lesson. I was called in during the year to advise a company manufacturing oil gas as to the best means of providing an illuminant for a town of about 6000 inhabitants; and I was specially requested to report on the *pros* and *cons.* of acetylene for the purpose. In estimating for the supply of acetylene, I found it very difficult to obtain reliable information as to supplies of calcium carbide over a lengthy period, and also as to its cost. On going thoroughly into the question in all its bearings, and especially as the works are situated in the centre of a very extensive coal-field, I reported against its adoption. Notwithstanding this, the Directors determined to go in for an installation. The costly experiment continued for a few weeks only; and the Company were forced to abandon their position and return to oil gas. It is interesting to chronicle here that the charge made for the gas was at the rate of £5 per 1000 cubic feet. Probably the principal cause of failure—apart from the prohibitive cost—was the use of burners which were not suited to the conditions generally. Shopkeepers and others complained of sooty deposits, and gave up the use of gas entirely. It is almost unnecessary to say that very considerable trouble was experienced in collecting the gas accounts.

At Dunfermline, for the year ending May 15, 1899, we have had an increase of 3,661,300 cubic feet in the sale of gas over the previous year; and this increase has been largely due to the use of prepayment meters, and also to the introduction of a differential rate, of which I gave some particulars at the meeting held in Ayr two years ago. I am now in a position to give some details of the working of the system during the past two years, first of all comparing the consumption with prepayment meters since their introduction in 1893-4—

Year.	October. Cubic Feet.	January. Cubic Feet.	April. Cubic Feet.	Annual Total. Cubic Feet.
1893-4	—	900	1,400	2,300
1894-5	58,200	65,600	65,100	188,900
1895-6	95,900	146,300	158,200	491,400
1896-7	221,200	395,300	324,200	940,700
1897-8	351,800	895,000	739,600	1,986,400
1898-9	771,500	1,823,100	1,367,500	3,962,100

You will notice that this is a repetition of the "same old story," which shows immense growth in this class of business. In our case, we have practically doubled each year since we commenced. I do not find in any of the statistics published in reference to the working of prepayment meters and free cookers in connection therewith, that any figures have yet been given for Scotland. The following may, therefore, be of interest. During the last year we had fixed in Dunfermline, for the full period, 111 prepayment meters, to which free stoves were attached, and 359 prepayment meters without stoves. The average consumption per meter was 8786 cubic feet in the former case, and 5761 cubic feet in the latter; showing that an additional consumption of 3025 cubic feet, or 52 per cent., was due to the stove. I find that, as a rule, the class of consumer using the stove does not appreciate the oven nearly so much as the boiling burner on the top of the stove; and in many cases the oven is never used at all.

The consumption under the heading of a differential rate (that is, a special rate for heating, cooking, and motive power purposes) has been, since its introduction two years ago, as follows:—

Year.	October. Cubic Feet.	January. Cubic Feet.	April. Cubic Feet.	Annual Total. Cubic Feet.
1897-8	1,766,300	1,344,200	1,419,200	4,529,700
1898-9	3,081,800	1,825,000	1,847,800	6,754,600

A great deal has been said lately for and against the system of a differential rate. In our case, it has proved an unqualified success; and my most sanguine hopes have been fully realized. At the time of its introduction, gas for lighting purposes was sold at 3s. 7d. per 1000 cubic feet; while coal was retailing at 10s. to 11s. per ton. Our interest and sinking fund charges were high; and had we been obliged to pay the latter, they would have amounted to over 1s. 10½d. per 1000 cubic feet of gas sold. It was, therefore, absolutely necessary to do something to obtain additional business; and in a one-trade town, with that trade in an unsettled state at the time, the development of prepayment meters and the adoption of a differential rate seemed the only possible openings for new business. With the increased consumption of gas, the figure for interest and sinking fund charges has been reduced to a trifle less than 1s. 7d. per 1000 cubic feet sold.

Our Association have, unfortunately, to record the loss of several members during the year. Death has removed some from our ranks; while others have discontinued their membership. But I am glad to be able to note accessions, which have, notwithstanding the losses, brought up our membership to a numerical strength in excess of that of last year. I trust that the new blood introduced to-day will add to our vigour as a real live Association. It may, perhaps, not be out of place if I mention here a difficulty felt almost every year by your Committee. I refer to the difficulty we have experienced in obtaining volunteers for the work of submitting papers. May I here ask the members generally, and particularly the junior members, to do what they can to lighten this part of the Secretary's work. We owe a great deal to the energetic way in which he carries on the business of the Association; and I am sure he would appreciate it very much if, by way of a change, a few papers had to be declined, owing to the shortness of time at the Committee's disposal for the annual meeting.

Gentlemen, we are to have a valuable lecture and a paper submitted to-day; I will not, therefore, trespass further on your valuable time.

Mr. T. WILSON said he was sure the members were all much indebted to Mr. Pooley, their worthy President, for his address. He personally was exceedingly sorry that it was a presidential address, because he should have liked to go into some of the figures contained in it. But they must take it as it had been given; and he had much pleasure in moving a hearty vote of thanks to Mr. Pooley.

This having been accorded,

The PRESIDENT said he was very much obliged to the members for the manner in which they had received his address, and for the cordial vote of thanks they had passed to him.

Mr. A. YUILL (Alloa) then read the following paper:—

ARTIFICIAL LIGHT, WITH SPECIAL REFERENCE TO GAS AND ELECTRICITY.

The circumstances under which we live are much altered since the time when the curfew bell warned all loyal people to extinguish their lights and fires at eight o'clock in the evening. The simple lives and habits of our forefathers called for no more labour at their hands than could be accomplished between sunrise and sunset; so that artificial light was to them a matter of secondary importance. But all is now changed. We no longer consider that our day's work is over when darkness comes upon us; indeed, a large proportion of the population are more busy during the night hours than at any other time. Hence the possession of some reliable and effective means of procuring artificial light becomes almost as much a necessity to us as our daily bread.

The question may be asked, How was the first light obtained? Those who have travelled and come into contact with aborigines tell us they have been initiated into the mystery of obtaining light by friction through rubbing two sticks together—a task easily accomplished in the hands of native Africans and Indians at the present day. In the hands of the chemist, light can be produced by much more simple means. In the far northern regions, the only source of light obtainable is the oil or fat got from the seal or walrus, which is burned in cruses, and which was much in evidence in our own country a century or two ago. Perhaps some of you may remember or have seen in some rural district, three or four decades ago, a primitive method of obtaining light by placing a piece of gas coal on the front hob of the grate, which often supplied all the light that was required. Candles and oil lamps were the principal sources of light available until the beginning of the present century, when gas was first introduced. Its adoption met with great opposition; and lectures in all parts of the country proclaimed the direful effects that would follow its introduction. The antagonistic feeling thus aroused may be compared to the strong prejudice previously evinced against the use of coal as a fuel.

In the production of artificial light there are two methods by which it may be obtained—(*a*) by the combustion of matter or elements; and (*b*) by the incandescence of matter or elements. We have an example of combustion by the burning of coal, wood, gas, or any carbonaceous material, which invariably undergoes a change of form. We have an example of light from incandescence by the caloric power of any gas impacted or impinging against any of the alkaline earths, or by a current of electricity passing through a platinum wire, which offers a certain resistance to its passage, or through a filament of carbon enclosed *in vacuo*.

The main essential in the combustion of any combustible material is oxygen, which may either exist in the gaseous state or in combination with the combustible material, such as gunpowder, nitro-glycerine, or any explosive compound. Knowing

the part which oxygen plays in the development of combustion, we can better understand the genesis of flame. There are few phenomena in Nature so wonderful as the flame of a candle, oil-lamp, gas, or the burning of coal in our fireplaces. Yet, who pays any particular attention to them? Very likely that familiarity, which is responsible for so much neglect, may also account for this indifference. In the study of a gas-flame we are confronted with a more complex compound. It is a mixture of several gases; but an ultimate analysis of it would show the component parts to be principally carbon and hydrogen, which, in combination with the oxygen of the atmosphere, burn to carbonic acid gas and water.

Notwithstanding all the wondrous achievements of the ancients—their magnificent monuments and buildings, their sculpture, their pottery, and their knowledge of many valuable arts, which have long since been lost—they appear to have been totally unacquainted with the existence of gases. The first recorded instance of the production and storage of a gas is that given by the Hon. Robert Boyle, who experimented on hydrogen gas by dissolving pieces of iron in an acid. The evolution of the production of the "spirit of coal," as it was termed, passed through many vicissitudes and many decades. But there was still wanting the master mind to suggest the means of carrying it into practical operation by storing the gas, and conducting it through pipes to any place that might be desired, to give light and heat. The difficulty was solved by a Scotsman, William Murdoch, in recalling the honour paid to whose memory (the last time we met in Stirling, a few years ago) we all take a pleasurable delight.

Of all the improvements that the active march of scientific research and enterprise has called forth during the last half century, that brought about by the continually increasing demand for artificial light is by no means the least prominent. The whole facts of the case, however, are not covered by the simple assertion that there is an increasing demand for artificial light. The progress of science and enterprise has also brought with it increased competition. Trade expenses are watched and scrutinized with a care and acuteness that are also continually increasing, with a view to bringing them down to the lowest possible point of economy. The gas account, which was formerly passed for payment as an unavoidable charge, like the poor-rate or income-tax, is now carefully checked and examined to see whether similar lighting effects could not be obtained by other methods at less cost.

For many years after the first introduction of gas lighting, the apparatus generally employed differed somewhat from that found in well-equipped works at the present day; but as the improvements made are now so well known to the members of the gas profession, I am saved the necessity of particularizing. No matter how well equipped individual works may be, the gas engineer of to-day has still the same difficulties to contend with as those experienced by his predecessors in the past. With reference to internal fittings of houses, I fail to see why local authorities are so anxious to have every detail connected with the sanitary arrangements of a house arranged in such a way as to render escapes of sewage matter almost impossible, while they overlook (or fail to supervise) the internal gas-fittings of houses. I am of opinion that Gas Associations ought to raise the question and bring it prominently before the Sanitary Congress, with the view of having all gas-fittings in houses properly tested and of ample size before occupancy.

No doubt it will be the experience of many of the members to be called upon at times to advise as to the most economical method of lighting by gas. A great many factors enter into this at the outset; but in considering the best type of burners, I unhesitatingly recommend the newer form of incandescent gas-burner, as from it the consumer gets the maximum amount of light at the minimum of cost. One source of defective light, when ordinary burners are used, is in the liability to forget that they are getting old. It has been my experience in some cases that the consumer could not remember when the burners were changed. They imagine that, like Tennyson's brook, they "go on for ever." To get the full advantage of the gas consumed from ordinary burners, the consumer ought to be advised to have them changed at least once a year.

Another cause of complaint is due to the form of globes used, obstructing, as some of them do, from 5 to 50 per cent. of the light. Globes, in my opinion, have only one object to serve apart from the æsthetic or decorative point of view—that is, to prevent cross currents of air from chilling the flame and thereby preventing the illuminating matter from being fully utilized. Globes with narrow openings at the bottom should not be used. Should any one be desirous of placing himself in a position to complain regarding the illuminating power obtained, I would advise him to get an old burner that has been in use for a number of years and cover the flame with a ground-glass globe with a small opening at the bottom and with a profusion of flowers painted thereon, when, no doubt, he will get the object of his desire.

The continued prosperity of the gas industry is a matter for congratulation, especially at the present time, in view of the enormous amount of lighting now being done in the principal towns and cities of the United Kingdom by our firmly-established competitor, the electric light. On the face of it, it would seem almost incredible that these numerous electric lighting companies can go on increasing their business so enormously as they are doing—taking over, to some extent, the cream of the gas consumers—without affecting in the least the ever-increasing demand for gas. That the advance of electricity has so little effect upon gas sales cannot be other than a source of great satisfaction, more especially in towns where the gas supply is in the hands of the local authority. The electrician will doubtless go on effecting improvements that will gradually reduce the cost of the electric current; and it is scarcely necessary for me to say that we who make gas are equally determined to follow the same aim, and bring about the same results in our sphere. We have much to encourage us in the study of incandescent gas-lighting and other developments in various directions, which prove that gas is almost as much in its infancy as is the generation of electricity. In proof of this let us take the make of gas in the United Kingdom. From statistics published by the Board of Trade relating only to gas corporations and incorporated gas companies, we find that in 1887 90,000 million cubic feet were manufactured, whereas in 1897 132,000 million cubic feet were made—an increase of 42,000 million cubic feet, or 46 per cent. more. This increase may be best shown by taking the monetary value of the increased quantity made at a rate of 2s. 6d. per 1000 cubic feet, which would represent a sum of not less than £5,250,000 paid for gas in 1897 in excess of what was paid ten years previously. The total amount of gas made in the United Kingdom by gas companies and corporations last year was 140,600 millions, representing a monetary value of £17,575,000 at 2s. 6d. per 1000 cubic feet.

Acetylene gas, which was so much in evidence a few years ago, was known to scientists as far back as 1836. But it was only in 1894 that a new and cheaper method for the manufacture of calcium carbide was discovered. A great future was predicted for this gas; but it has failed to establish itself, because of its costliness. In isolated districts, or where the cost of gas is high, it may prove its usefulness; but great precautions require to be taken in storing calcium carbide, as it is now ranked as an explosive, and placed in the category of inflammables.

Wonderful as the present century has been in all that pertains to the development of science, the twentieth century promises, in one respect, to surpass it. The present century may be considered as the triumphant period of the civil engineer—the Alexander of modern times, who has so little to conquer. Some consider that the twentieth century will be the apotheosis, so to speak, of the electrical engineer and of his scientific brethren who engage in the investigation of electricity and ether.

Naturally the question presents itself: "What is electricity?" That it will be answered within the next few years is certain. The advance of electrical science enables us to arrive at a very shrewd and close definition respecting this agent. It surrounds us (it exists in our bodies); is in or upon everything. It cannot be produced by any human agency. It is——well, we can say no more. Although we may not be able, satisfactorily, to give a definite answer of what electricity is, still we can demonstrate how it may be produced and saddled for our requirements and uses. In the generation of electricity, three modes of power may be used: (*a*) steam-engines; (*b*) gas-engines; and (*c*) natural forces. The last may be sub-divided into two classes: (1) water power, (2) wind power. [Since these lines were written, I have been informed that it can be obtained from other sources—by heat.]

In large installations, where a considerable electro-motive force is required, steam-engines may be said to be the best power; but in small installations, or where the electric current is generated for private use, gas-engines are the most economical. In positions conveniently situated, water power may prove economical; but I cannot help remarking that this available power is considerably over-rated by some. It is generally looked upon as a safe rule, in calculating the power of water, that 1 cubic foot of water falling 15 feet per second will give 1 electrical horse-power per hour.

The two recognized systems of electric lighting are the arc and the incandescent. Perhaps it will be known to some of you that electricity, in the form of the arc light, was discovered by Sir Humphrey Davy about 100 years ago; so we must not imagine that "the light of the future" is a child of yesterday, as some term it. The arc light is by far the cheapest mode of electric lighting, when the intensity of the light is taken into account. This must necessarily be so, as the arc light is obtained from the incandescence produced by the combustion of the carbon, caused by the flow of electricity between the carbon points. The light from the incandescent lamp is obtained from the heat of the carbon filament—no combustion of the carbon taking place. In fact, most of the electrical energy passed through an incandescent lamp is converted into heat and not into light; hence the reason that the one is more expensive than the other. If we take the electrical power required to give an effective light of (say) 800 candles with arc and incandescent lamps, the approximate power would be, for an arc lamp of, say, 800 effective candles, ½ to ¾ horse power; while for incandescent lamps to give an aggregate light of 800 candles (fifty 16-candle power lamps), 6-horse power would be required. Thus 1-horse power would give 160 candles by using incandescent lamps, and it would give 1200 candles by using an arc lamp.

It is a recognized fact among gas engineers that the gas, as ordinarily consumed, gives a very small percentage of light from the percentage of carbon it contains. The potential energy stored in the gas is largely converted into heat; in fact, it is

from this transformation of energy into heat that any light is obtained. Heat and light go hand-in-hand; and the investigations of some gases have shown that curious anomalies exist, which are worthy of study by scientists. The light obtained from gas by an ordinary jet gives almost the lowest percentage of illuminating value compared with any other system. If we take gas of (say) 25 candles, it would give, with an ordinary jet, an illuminating value of 5 candles per cubic foot; but if consumed with the new form of incandescent burner, 25 candles per cubic foot of gas would be obtained. In fact, in this form, they claim 30 candles per cubic foot. But suppose that, instead of consuming the gas, we convert the potential energy into electrical energy by means of a gas-engine of (say) 10 effective horse-power. This engine would require (say) 20 feet of gas per horse-power per hour, or 2000 cubic feet in all. This power would be capable of supplying electrical energy for (say) 15 arc lamps, each giving 800 candles effective, or a total light of 12,000 candles, equivalent to 60 candles per cubic foot. Were the gas consumed in the ordinary way, by using ordinary burners, 1000 candles only would be obtained. In making these comparisons, allowance must be made for the interest and depreciation of the electrical plant, together with the cost of making, which I have no doubt would equal, if not surpass, the cost of obtaining equal lighting value by using the new form of incandescent gas-burner.

In making a calculation as to the total gas made last year in the United Kingdom I find that the respective countries stand as follows:—

	Cubic feet.	
England	125,000,000,000	or 88·15 per cent.
Scotland	11,700,000,000	,, 8 32 ,,
Ireland	3,900,000,000	,, 3·53 ,,
Total	140,600,000,000	100

To show the gigantic importance of the gas industry to the coal trade, it may be mentioned that over 14 million tons of coal are required every year.

In dealing with electricity, last year the following statistics were furnished to the Board of Trade:—

	Local Authorities.	Companies.	Total.
Capital	£5,021,399	£6,884,764	£11,906,163
Revenue	£603,768	£881,027	£1,484,795*
Units sold . . .	35,319,543	40,814,688	76,134,233
Kilowatt capacity .	53,238	59,053	112,291†
Horse-power‡ . .	71,364	79,160	150,524
Lamps fixed. . .	2,090,232	2,544,191	4,634,423

* Price equal to 4·68d. per unit.
† Equal to 3,743,033 8-candle-power lamps.
‡ Calculated at 746 kilowatts per horse-power.

It is generally considered that 80 cubic feet of gas are equal to 1 unit of electricity; and this, multiplied by the total units of electricity sold, represents 6,090,738,000 cubic feet, or 4·33 per cent. of the quantity of gas made per annum, which amounts to nearly the average annual increase of gas companies. That is, taking the total output of both, we have gas displaced which only amounts to 4·33 per cent. of the total gas made.

One point in considering the above statistics from a comparative point of view is the capital required by electrical companies and local authorities in comparison with their output. We find that they require £11,906,163 to produce 76,134,233 units; and from the above calculation it will be seen that this quantity is equivalent to 6,090,738,000 cubic feet of gas. Taking £500 per million cubic feet as capital expenditure for new works, the above quantity of gas could be dealt with by an expenditure of £3,045,369 against £11,906,163 by electrical companies, which tells greatly in favour of gas undertakings.

A great deal could be said in comparing gas and electricity; but the length of this paper, and the short time I have had for its preparation, form a sufficient excuse for bringing my remarks to a close.

Discussion.

The PRESIDENT said they had had a most interesting paper from Mr. Yuill, setting forth the relative values of gas and electricity; and he invited remarks or questions upon the paper.

Mr. J. M'GILCHRIST (Dumbarton) thought that Mr. Yuill's paper was more of the nature of an address than of a paper to be discussed. He looked upon it as most interesting; but, if he would be allowed to tell them a story, it reminded him of the Irishman who, when he went to Niagara, saw the water coming down, and, on being asked if he were not surprised, replied that he was not, that he would be surprised if it were the other way. So, he thought, most of them would be surprised at Mr. Yuill saying so much in favour of gas. Really it was too bad. He thought that Mr. Yuill might have said a kindlier word for the electric light. It had come to stay; there was no mistake about that. In regard to other modes of lighting he (Mr. M'Gilchrist) did not think they were of so much account; but in regard to electricity, he thought that they, as gas managers, should not make too light of it.

Mr. A. MACPHERSON (Kirkcaldy) was sure Mr. Yuill had given them statistics in the paper which, when they came to study it, they would profit much by. Unlike Mr. M'Gilchrist, he could not say that Mr. Yuill had been, what he might say, hard on the electric light. He had, in his opinion, stated the bald facts, and compared the light which could be produced by electricity, and the cost of producing the light, with what could be got from gas, burned in the various ways in which it was now consumed. In this, he (Mr. MacPherson) thought that Mr. Yuill had done a very wise thing, because it showed them that, however much, and however loud, the noise made about the electric light, gas was not only holding its own, but was still progressing, and he had no doubt, even though the electric light (as Mr. M'Gilchrist said) had come to stay, that from it they had nothing to fear, in the matter of the consumption of gas improving. He could only say that, so far as their experience had gone in the past, that the electric light had been a great friend to gas people. It caused a demand for more light, and those who could not get the light from electricity, naturally fell back on the cheaper, and, he would not say better, but equally serviceable, gas light. In this way it had, he thought, considerably increased the consumption of gas; so that it had really done them a friendly turn. But not only so; it had also urged them forward. He was not such a very old man; but he was old enough to remember that for years gas engineers rested on their oars and did nothing. They supplied gas, and it seemed immaterial to them whether consumers received the full benefit of the gas or not. Now things were changed. A great many people had set themselves to solve the problem of how to make gas cheaper and better, as an illuminant, than the electric light. In this way not only had they benefited gas managers, but they had made them take a more direct interest in the light which the consumer received from the article which they supplied; thereby, to a very considerable extent, benefiting the consumers of gas also.

Mr. W. BRIGGS (Dundee) remembered years ago discussing the question of electricity *v.* gas with one of the members of the Association, who said to him that electricity never would compare with gas, because of two facts—the one that it could not be stored, and the other that if the light were cut off from a portion of a building, it would be cut off from the whole. Now, they knew that these difficulties had been overcome; and he was very glad to hear the remark that they should not treat electricity with disdain.

Mr. T. WILSON (Coatbridge) wished to corroborate the remarks of Mr. Yuill; and it might not be uninteresting to give them a history of an Electric Light Company in the town of Coatbridge. Some years ago, a House-to-House Electricity Company applied to Parliament for powers to put down an electric installation, in opposition to the Gas Company—incorporated by Act of Parliament. He, as an individual, and as representing the Gas Company, opposed the application. Council for the promoters asked what he was present for. He replied that he was Manager and also Secretary of the Coatbridge Gas Company. The Chairman of the Committee thereupon said: "Then you are here for a selfish motive." He said: "I beg your pardon, I am here trying to get fair play. I think it is scarcely fair that Parliament should, in 1877, grant power to a local Gas Company to spend £50,000 for the purpose of lighting the district, and should now grant powers to a foreign company to come in and snuff us out." The Chairman took his view of the matter, but they were not successful; and powers were granted to the Electricity Company. They put down plant which cost from £26,000 to £30,000, and things looked blue for the Coatbridge Gas Company. They were then making about 60 million cubic feet of gas a year. Well, the plant which the Electricity Company put down was not suitable; and it was replaced by other plant. That, in turn, proved to be quite as unsuitable; and they had it replaced again, and he believed they had not, even yet, a model installation of electricity in Coatbridge. He was sorry for the Electricity Company, but it was the fact that the community had not taken advantage of its services. They had very few customers, and they were struggling hard to keep things going. There was no doubt that this year they would have a big loss, as they had last year. They did not do the Gas Company much harm by the ordinary consumers they took over; but they had brought the matter under the notice of the iron masters, and there was not a single one of them who had not introduced an installation of electricity. He supposed that the Gas Company had lost some 20 million cubic feet of their output in this way. But still they were increasing in their consumption otherwise. This year they had an increase of something like 18 or 19 million cubic feet. And so, electricity had not injured them in any way. They were able to sell gas at 2s. 6d. per 1000 cubic feet. Their's was an incorporated Company, and had to pay 10 and 8 per cent. on their capital. It took 10½d. per 1000 cubic feet to pay their dividend; while Mr. Ewing, his neighbour, slipped through with 2½d. per 1000 cubic feet. There was no doubt that electricity had come to stay with them; but they need not get afraid of it.

Mr. M'GILCHRIST pointed out that, while Mr. Wilson said that electricity had done him no harm, he said he lost a consumption of 20 million cubic feet a year, through electricity having been introduced into the iron-works.

Mr. WILSON: We are gaining, on the other hand.

Mr. M'GILCHRIST: It is the loss I am referring to.

Mr. D. VASS (Edinburgh) said that Mr. Yuill gave the quantity of gas made in 1887, and the quantity made in 1897; and he assumed a figure. He thought that if they were to get the net figure it would improve the matter, because the revenue would not be the same in both years, else they would be making no progress in the way of reducing the price of gas. He thought it would be matter of interest to them if Mr. Yuill could give them the correct figure, instead of an assumed one.

The PRESIDENT said there were one or two things in the paper which he considered highly important. There was the question of gas-fittings in houses. In Dunfermline, he had had great trouble in getting gas-fitters and architects to put in fittings of sufficient size. In one case of a house with, perhaps, 80 lights, there were several large sections lighted with No. 8 internal compo. piping, which was altogether inadequate; and, of course, it was impossible to prevent complaints arising. Mr. Yuill also mentioned the small openings at the bottom of globes. There was one plumber in their town, who, certainly, in other matters, kept himself ahead of all others, but who had, actually, to-day, no other globes for sale in his shop except with the smallest of openings.

Mr. YUILL, in reply, said as to Mr. M'Gilchrist's remarks, he had only given the facts in his paper as he had been able to find them; but he had got no antagonistic feeling towards the electric light. To show that this was so, he might mention that they petitioned Parliament for a Provisional Order (and got it last month) for lighting Alloa by electricity. They intended to establish the installation at the gas-works, to be worked by gas-engines; and so, it was probable that within two years, they might be in a position to supply not only gas, but electricity for both light and power. Perhaps this might tend to satisfy Mr. M'Gilchrist. Mr. Wilson mentioned the difficulties he had experienced in dealing with the electric light, and the bad position in which the Electric Lighting Company in Coatbridge was in even to-day. He thought that any of them who knew Mr. Wilson would expect that, with his winning ways and persuasive powers, he would come off victorious in dealing with consumers, and have the whole house lit with gas. Mr. Vass raised a point about his giving the revenue from gas ten years ago. It was a simple calculation. If they took the average price of gas now at 2s. 6d. he thought that most of them must admit that if they took the price of gas ten years ago, it must be a little more. So that he had only taken the difference in the selling price; and anyone could make the calculation for himself. He thought it would be misleading to take the price of gas ten years ago. Then, perhaps, they would notice that, at the end of his paper, the total quantity of gas made for the past year was given—so far as it could be ascertained; and anyone could thus calculate for himself what the monetary value would be. No one, except the President, had touched upon the subject of gas-fittings in houses. In his (Mr. Yuill's) opinion, it was the crucial point. He thought they should take it up. He considered it a question of far more importance than meter-unions. It affected not only the health of the people who lived in the houses, but the prosperity of the very gas undertaking itself.

ELECTION OF OFFICE-BEARERS.

The SCRUTINEERS (Mr. J. Hepworth, of Edinburgh, and Mr. Lamb, of Manchester) reported the result of the ballot for the election of office-bearers as follows:—

President.—Mr. W. Ewing, Hamilton.

Vice-Presidents.—Mr. W. R. Herring, Edinburgh; Mr. J. Henderson, Newton-on-Ayr.

Secretary and Treasurer.—Mr. R. S. Carlow, Arbroath.

Members of Committee.—Mr. T. Lighbody, Renfrew; Mr. Forbes Waddell, Forfar; and Mr. A. MacPherson, Kirkcaldy.

Auditor.—Mr. R. B. Main.

Mr. M'GILCHRIST said it had been reported to him that there was a way of getting votes by circular. He should like the President to say whether this was a legal proceeding. Was it not the rule of the Association that the ballot-paper was the only way of ascertaining the minds of the members as to the governing body of the Association.

The PRESIDENT: Yes; that is the way. If we had any proof of systematic getting of votes otherwise, they should be ruled as incompetent.

PLACE OF NEXT MEETING.

It was resolved that the Association meet in Edinburgh next year.

Professor W. IVISON MACADAM (Edinburgh) then delivered a lecture on "Carburetted Water Gas," of which the following is a summary. The lecture was illustrated by diagrams and views, shown by means of the limelight.

CARBURETTED WATER GAS.

The subject I am to lay before you cannot now be said to be a new one; for within the last few years the process of the manufacture of carburetted water gas has been adopted in many—I might almost say most—of our large cities and towns. Not only is the process a rapid and comparatively easy one to work, but the enormously less space required for the plant, the ease by which the quality and even quantity may be varied at the pleasure of the operator, as well as the almost complete absence of dirt and dust, are points which no gas manufacturer can afford to neglect. Still, however, many gas managers have not yet had an opportunity of studying the subject and seeing the plant; and it has, therefore, seemed desirable that the subject should be brought before you this day.

The reactions necessary for the production of this gas are neither difficult to understand nor novel; and they may be represented thus—

(*a*) Carbon and air = carbonic anhydride and nitrogen.
(*b*) Carbonic anhydride and carbon = carbonic oxide.
(*c*) Carbonic oxide and air = carbonic anhydride and nitrogen.
(*d*) Carbon and steam = carbonic anhydride and hydrogen.
(*e*) Carbonic anhydride and carbon = carbonic oxide.

The plants now most commonly in use are known as the Humphreys and Glasgow and the Economical Gas Apparatus Construction Company (Merrifield-Westcott-Pearson patents).

The Merrifield-Westcott-Pearson plant consists of two special pieces of apparatus—one, the generator, and the other a combined carburetter and superheater. The remainder consists of washer, condenser, purifiers, &c.; and these do not differ materially from similar apparatus in use in coal gas works. In the plant now under consideration, the combined carburetter and superheater is really two pieces of apparatus—the lower part being the carburetter, and the upper part the superheater. The Humphreys and Glasgow apparatus is constructed in three parts: (*a*) a generator, (*b*) a carburetter, and (*c*) a superheater—so that the essential difference in these two styles of apparatus lies in the combined carburetter and superheater of the Merrifield-Westcott-Pearson plant, as against the separate carburetter and superheater of Humphreys and Glasgow.

In considering the separate parts of the apparatus I will specially explain the Humphreys and Glasgow style, as being more readily understood. The generator is simply an iron casing lined with fire-brick, and closed top and bottom. The fire-bars are raised some distance from the lower end, and can be reached by means of air-tight doors. The coke or other carbonaceous fuel is introduced at the top by means of a door. The fuel is dropped in from a specially constructed hopper truck, which can be readily run over the upper opening. In this way, charging does not take more than a few seconds; and the fuel does not require to be handled. By means of pipes, air or steam may be driven into the generator as required. The carburetter is also an iron cylinder lined with fire-brick, and filled in with bricks so as to make a checker-work, and thus expose great surface. Instead of fire-bricks, the upper part is filled with iron bars. It is in this apparatus that the oil required to give luminosity to the water gas is introduced, and it is found in practice that if the oil is allowed to fall on hot bricks, these are somewhat readily destroyed. Iron bars, therefore, replace bricks in the upper part. The carburetter is also furnished with an air-blast. The superheater is rather larger than the carburetter, but is otherwise very similar. As, however, it is in one of the operations the end of the system, it is furnished at the upper part with a door, by which the products of combustion may be allowed to escape. It is, like the carburetter, filled with brick checker-work. An air-blast can also be turned on to the superheater.

Suppose now that the apparatus is ready to heat up. A coke fire is lighted in the generator, and by means of an air-blast is compelled to burn in the closed vessel. The carbon of the coke, along with the oxygen of the air, forms carbonic anhydride (carbonic acid). The combustion so set up heats the upper layers of coke, with the result that the carbonic anhydride attacks the coke and becomes carbonic oxide.

$$C + \text{air} = CO_2 + N$$
$$CO_2 + C = 2\,CO.$$

One essential difference between carbonic anhydride and carbonic oxide is that, while the first gas cannot burn, the second is readily combustible. It will thus be seen that the heating up of the generator is due to ordinary combustion of carbon and oxygen, and that the final product is a combustible gas (carbonic oxide). The composition of the gases escaping from the generators at this stage is—

Composition of Generator Blast Gas.

Carbonic anhydride	9·7
Carbonic oxide	17·8
Nitrogen	72·5
	100·0

From the generator, the escaping gases are passed to the carburetter, where they meet with a further air-blast, so nicely balanced as to burn only a portion of the carbonic oxide, with the result that, while a part of the carbonic oxide is burnt to heat the carburetter, a part also escapes combustion. The action in the carburetter may be said to be as follows:—

$$CO_2 + 2\,CO + \text{air} = 2\,CO_2 + CO + N.$$

The gases from the carburetter then pass to the superheater, where once more air is forced in. In this operation the remaining gaseous carbonic oxide is burned up; and the products of the combustion are allowed to pass to the outside air. The air-blast used is under a pressure of 12 to 15 inches of water, and is obtained by centrifugal fans worked by steam, at a rate equal to 2000 revolutions per minute. The composition of the heating-up gases, as leaving the superheater, is shown in the following table:—

Composition of Blast Products as Escaping from the Superheater.

Carbonic anhydride	17·4
Oxygen	3·2
Nitrogen	79·4
	100·0

It will be observed that all the carbonic oxide has, during these processes, been converted into carbonic anhydride, and that therefore no combustible gas leaves the superheater. The whole apparatus (generator, carburetter, and superheater) has, therefore, been heated by the coke in the generator.

When the temperature has been sufficiently raised—1000° to 1200° C. (1000° C. = 1832° Fahr.)—the air supply is entirely cut off, and the door at the top of the superheater shut. The valves between the superheater and the washer and condenser are opened, and steam, at a pressure of 130 to 140 lbs. per square inch, is introduced into the generator, with the result that the hot carbon decomposes the steam, forming a mixture of carbonic anhydride and hydrogen—

$$2\ H_2O + C = CO_2 + 2\ H_2.$$
Steam.

And, secondly, the carbonic anhydride, meeting with the hot carbon, acts as before—

$$CO_2 + C = 2\ CO.$$

At this stage, therefore, the gases escaping from the generator are the combustible carbonic oxide and hydrogen, with a proportion of carbonic anhydride. The composition of the gas is as follows:—

Uncarburetted Gas, "Water Gas."

Carbonic anhydride	3·5
Carbonic oxide	43·4
Hydrogen	51·8
Nitrogen	1·3
	100·0

The coke from 1000 cubic feet of ordinary coal gas will yield 3000 cubic feet of water gas.

Now, while the temperature of the flame of burning hydrogen is 3259° C., and that of carbonic oxide is 3042° C., yet the flames are practically not luminous. The generator gas is, therefore, passed to the carburetter, where it meets with a very fine spray of paraffin oil, which is vaporized by the heat of the generator gases, and carried forward to the superheater, where it is broken up, or more possibly cracked and converted into permanent gas of high luminosity. Russian Solar Distillate, sp. gr. 875, and flashing at 170° to 200° Fahr., gives for each 5·46 lbs. of oil 1000 cubic feet of 25-candle power gas, and the fuel required per 1000 cubic feet of 25-candle power gas is 45 lbs. The operations in the carburetter and superheater may be explained thus—

Carburetter.

Non-luminous gas + oil vapour = mixture of non-luminous gas + oil vapour.

Superheater.

Mixture of non-luminous gas + oil vapour = mixture of luminous and non-luminous gas.

The composition of the gas is as follows:—

Composition of Unpurified Carburetted Gas.

Carbonic anhydride, Sulphuretted hydrogen	3·8
Heavy hydrocarbons	14·6
Carbonic oxide	28·0
Marsh gas	17·0
Hydrogen	35·6
Nitrogen	1·0
	100·0

Any condensable hydrocarbon is removed by the washer; and the sulphuretted hydrogen and carbonic anhydride are taken out by lime or lime and oxide of iron in ordinary gas-works purifiers. There is nothing novel in the method of purifying the gas, as only the ordinary systems, so well known, are employed. There is only a slight proportion of sulphuretted hydrogen; and it comes to be a matter of consideration whether it is cheaper to remove the carbonic anhydride, or to simply increase the proportion of oil used, and so overcome the loss of luminosity due to the presence of that gas.

It can be readily understood that, with such operations, it is essential to save as much heat as possible; and with this end in view, the oil is heated before it is allowed to pass to the carburetter. Humphreys and Glasgow use the waste heat of the superheater; while the Economical Gas Apparatus Company prefer to use the waste heat of the cooling apparatus. It will be readily understood that the manufacture of the gas from coke, steam, and oil rapidly reduces the temperature of the whole apparatus; and therefore it is necessary, after a period of from five to seven minutes, to cut off the oil supply, shut the valves between the superheater and the purifying plant, open the upper door of the superheater, and repeat the heating-up process by means of the air-blasts as before. This operation means a loss of about four minutes, after which the manufacture of luminous gas may be repeated. This cooling is shown very well by the increase in the proportion of carbonic anhydride in the gases as passing off from the generator. After four minutes, the proportion is nearly 5 per cent.; and after seven minutes it is fully 12 per cent. The actual figures are:—

Composition of Generator Gases.

	1 min.	4 min.	7 min.
Carbonic anhydride	0·8	4·7	12·1
Oxygen	0·0	0·0	0·0
Carbonic oxide	48·2	40·6	29·9
Hydrogen	48·6	52·7	56·1
Nitrogen	2·4	2·0	1·9

The analyses of the average make of the unpurified and purified carburetted gases at the Liverpool works is as follows:—

Unpurified Carburetted Gas.

Carbonic anhydride	4·1
Heavy hydrocarbons	11·8
Oxygen	0·0
Carbonic oxide	30·1
Methane	20·7
Hydrogen	28·7
Nitrogen	4·6
	100·0

Purified Carburetted Gas.

Carbonic anhydride	0·0	0·2
Heavy hydrocarbons	12·3	11·7
Oxygen	0·0	0·1
Carbonic oxide	32·0	32·1
Methane	21·2	21·2
Hydrogen	28·2	28·8
Nitrogen	6·3	5·9
	100·0	100·0

For those who may desire more detailed information as to the actual constituents present in the gas, the following analysis of a sample of the Baltimore Gas-Works product may be useful:—

Hydrogen		46·49
Marsh gas		11·75
Carbonic oxide		21·51
Nitrogen		4·30
Oxygen		0·20
Olefine Series.	Ethylene	6·50
	Propylene	0·35
	Butylene	0·15
Paraffin Series.	Ethane	0·50
	Propane	1·00
	Butane	7·25
		100·00

The following table of the composition of ordinary cannel coal gas is given for comparison:—

Composition of Cannel Coal Gas.

Hydrogen	45·58
Marsh gas	34·90
Carbonic oxide	6·64
Heavy hydrocarbons	6·46
Nitrogen	2·46
Carbonic anhydride	3·67

On comparing this table with the previous results, it will be observed that the constituents present are the same, and that the main difference lies in the larger proportion of carbonic oxide, and the lower amount of marsh gas in the carburetted gas, as compared with the coal gas. If we consider the illuminating value of the constituents, we shall find that the substitution of carbonic oxide for marsh gas will not to any extent affect the luminosity, as, while these gases are practically non-luminous, marsh gas is in practice found to be more harmful to luminosity than carbonic oxide.

Lighting Value of 5 Cubic Feet.

	Candles.
Carbonic oxide	—
Marsh gas	5·2
Ethane	35·7
Propane	56·7
Olefine	70·0
Propene	123·0
Acetylene	240·0

The interchange of gases will, however, to some extent affect the thermal value of a definite weight of the gas, for a given weight of marsh gas is of more value for heating purposes than the same weight of carbonic oxide.

So far I have been making use of tables published by the patentees; but I now quote independent evidence. This can readily be given; for the Edinburgh and Leith Gas Commissioners have lately gone most fully into the matter, and have had the best scientific assistance procurable. The results which I now show fully corroborate the figures previously quoted, and distinctly prove that the claims of the patentees have not been exaggerated.

Unpurified Carburetted Gas.

Edinburgh Tests (Professor Crum Brown).

Carbonic anhydride	4·2
Heavy hydrocarbons	10·5
Oxygen	0·0
Carbonic oxide	32·8
Methane	16·5
Hydrogen	32·2
Nitrogen	2·8

Purified Carburetted Gas.

Edinburgh Tests (Professor Crum Brown).

	A.	B.	C.	D.
Carbonic anhydride	0·2	0·2	0·3	0·2
Heavy hydrocarbons	12·6	13·6	11·9	11·0
Oxygen	0·0	0·0	0·0	0·0
Carbonic oxide	28·6	26·6	29·9	30·5
Methane	15·9	19·9	18·0	17·5
Hydrogen	35·4	33·5	34·9	35·7
Nitrogen	7·3	6·2	5·9	5·1

Purified Carburetted Gas.

Edinburgh Tests (Mr. Stenhouse).

	No. 3.		No. 4.
Sulphuretted hydrogen	0·0	..	0·0
Carbonic anhydride	0·0	..	0·0
Hydrocarbon vapours	1·5	..	0·9
Heavy hydrocarbons	7·6	..	7·8
Oxygen	0·4	..	0·0
Carbonic oxide	30·0	..	30·7
Marsh gas	29·3	..	32·8
Hydrogen	19·9	..	18·0
Nitrogen	11 3	..	9·8
	100·0	..	100·0

Candle power, 20·22.

The last table may be compared with Mr. Stenhouse's analyses of the cannel gas as now supplied to the City of Edinburgh.

	First Analysis.		Second Analysis.
Sulphuretted hydrogen	0·0	..	0·0
Carbonic acid	0·0	..	0·6
Hydrocarbon vapours	1·2	..	1·2
Heavy hydrocarbons	7·2	..	7·6
Oxygen	0·2	..	0·2
Carbonic oxide	9 6	..	9·8
Marsh gas	38·4	..	38·4
Hydrogen	43·3	..	42·2
Nitrogen	0·1	..	0·0
	100·0		100·0

The question of cost is one which I am not qualified to deal with; but I may annex a table, the details of which have been compiled from the books of one of the most energetic and accomplished of gas-makers, Mr. Stelfox, of the Belfast Corporation Gas-Works.

Cost of Manufacture of 25-Candle Power Carburetted Water Gas.

	Pence.
Oil, 3⅜ gallons, at 2¾d.	10·10
Coke (including boiler fuel)—45 lbs., at 12s. per ton	2·90
Labour, total employed	1·50
Purifying materials	0·50
Repairs and maintenance	1·00
Water (if not re-circulated)	0·20
Management and sundries	0·80
Total cost per 1000 cubic feet made	17·00
Plus 5 per cent. lost in distribution	0·85
Total cost per 1000 feet sold	17·85
Cost per pound of sperm sold	0·208

This estimate does not include the value of residual tar, which is equal to 10 to 15 per cent. of oil used, and fetches in one works 19s. per ton, as against 21s. per ton for coal tar. From the character of the materials used, as well as of the plant, it can easily be understood that there is little or no dust and no smoke. All the disadvantages of the old retort-house are done away with. Of course, as coke is required, it is cheaper and better to continue the old process side by side with the new; but any manager can so regulate the excess production of coke that no more is made than can readily be sold, or he can even regulate matters so that no coke is sold. The coal gas can be easily mixed with the carburetted gas; and if once mixed the gases cannot separate, for gases are quite different from solids, or even liquids, as one of their essential physical properties is that they must mix, no matter what their densities be, and that once mixed they cannot again become layered.

The specific gravity of ordinary coal gas is about 470; of water gas, 570; the Belfast mixed coal and carburetted water gas, 545. The enriching value of carburetted water gas is about one-fifth, or 20 per cent., more than its nominal value.

Another great advantage is the comparatively small space occupied by these plants. Four complete sets can be placed in a building 95 feet by 55 feet; and this includes plenty of room, not only for the generators, carburetters, and superheaters, but also for the necessary boilers, air-fans, engines, a store-room, and office. But it does not include purifying plant or holders. Such a plant can easily manufacture 1,400,000 cubic feet of illuminating gas per day.

The great outcry against the carburetted water gas is that the largely increased proportion of carbonic oxide makes the gas very poisonous. Now, there can be no doubt that carbonic oxide is an extremely poisonous gas—in fact, so poisonous that even a small proportion in admixture is highly dangerous. In the Edinburgh coal gas there was nearly 10 per cent. of carbonic oxide. Now, such a proportion is most highly poisonous; and the mere increase in the proportion cannot make the mixture any more fatal. On the other hand, it has been suggested that carbonic oxide being odourless, it becomes more highly dangerous when in carburetted gas than when in coal gas. But those who urge this theory altogether forget that while their contention would be perfectly correct were pure water gas sent out to the consumer, it is absolutely unfounded when carburetted water gas is delivered to the mains. Those who have had experience of oil gas well know that such gas has a much stronger odour than ordinary coal gas; and therefore the mixture of oil gas and water gas, known as carburetted water gas, should it escape into a room, will be more easily and more early detected than coal gas would be. If the gas manager is to be compelled to turn out non-poisonous gas, he must shut up his works.

The PRESIDENT said he was sure the members were all very much indebted to Professor Macadam for his valuable contribution to the day's proceedings. If anyone had any questions to ask, he had no doubt Professor Macadam would give them satisfactory answers.

Mr. J. NAPIER MYERS (Saltcoats) said he understood Professor Macadam to say that while solids, and even liquids, might be mixed and separated, the same did not hold good of gas, but that when gases were once mixed there was no possible chance of separating them. He should like to know if the opinion held by some gas managers, that gases of different qualities were apt to form layers in a gasholder, was a fallacy. He could not say that he had experienced it himself; but he had frequently heard gas managers say this would result.

Mr. T. WILSON (Coatbridge) said Professor Macadam had furnished them with particulars of the different water-gas apparatus, and the working of them, and also the cost of working at Belfast. He thought he had omitted to give them the illuminating power in that city.

Professor MACADAM said it was 25 candles.

Mr. WILSON said this would enable them to determine whether coal gas or water gas was the more suitable.

Mr. A. BELL (Dalkeith) said he was sure they were all indebted to Professor Macadam for his lecture; for whatever he touched he brightened. He (Mr. Bell) had never had anything to do with the manufacture of carburetted water gas for illuminating purposes; but some years ago he was concerned with the manufacture of a gas containing from 15 to 20 per cent. of carbonic oxide. With regard to its poisonous properties, he was not so very sure that Professor Macadam had put the matter his way. The question he wished to ask was whether it was not cumulative—did not the human system hold water gas for much longer than ordinary coal gas? If they doubled the quantity of carburetted water gas, surely it must be more poisonous than the smaller quantity of carbonic oxide in coal gas. Suppose two men were asphyxiated, the one with coal gas and the other with carburetted water gas, which would be the more likely to recover? He held that the coal-gas man would, and that the other would go. In an oil-works, the place of which he was speaking—of course, it was a rough place, and no cutting off, requiring the apparatus to be shut down—if anything went wrong they had to cut in and let the gas blow freely. Some men could stand it well, but others very little. He himself could stand a great deal of coal gas without being asphyxiated. He had a man in his employment who, if he got three breaths of the gas they manufactured, went into convulsions. He was a fitter, and a good workman; but, being of no use to them, he had to leave. He went to Glasgow, where he could stand the old quantity of coal gas. This showed that there was a difference between the two gases. He had been twice asphyxiated himself. He had all his life made it a point that, wherever there was danger he took it himself, because he knew exactly the moment when to stop. With water gas, however, a man stood no chance; he simply went down like a stone. He had twice been carried out insensible. One poor fellow, after perhaps a dozen such cases, was incapacitated for life—the man became useless. He held that the gas was deadly poisonous, and that it was doubly dangerous to have twice the quantity of carbonic oxide in it. If they were using water gas, they surely must increase the danger. Many people had no smell. He had a man in his works who could allow gas to blow all round him, and not know of it. A man like this would be simply killed if he breathed water gas. He would like to ask Professor Macadam if the poison in this gas was not cumulative.

Mr. A. WILSON (Dawsholm) said that, as one who had had a little experience in the manufacture of water gas, he considered there was not much more danger with it than with coal gas. Nor did he think that there was any more danger in using it. Mr. Bell talked about men getting asphyxiated. He did not think that in his works men were ever in positions where they could be asphyxiated. He did not consider that a man should be placed in a position where he would get such a dose of gas—either coal gas or water gas—as would do him harm. But he really did not think it would make much difference whether it was coal gas or water gas. He thought the evidence was that the latter could be used just as safely as the former, and that accidents with it were not more frequent than with coal gas. The point, of course, which everyone must consider for himself was which was the more economical to make, water gas or coal gas. In some cases—certainly in his own experience—it was much cheaper to make coal gas and enrich with oil gas than to make carburetted water gas. There were thus circumstances where it might be more economical to use water gas; but in other cases he thought that coal gas, if it were economically made, would for a long time certainly hold its own with water gas.

Professor MACADAM said the first question put to him was by Mr. Myers, as to gases layering. In answering this question, he thought he must, in the first place, draw attention to the fact that he said that "gases when once mixed cannot layer"—that was to say, that if they mixed gases thoroughly, as should be done, they could not be again separated from one another. They could not have heavy carbonic acid separated from light hydrogen when once they were mixed together. This was a well-known physical condition. If they were to send into the gasholder probably a heavier gas at one time than at another, they might have, for a time, what was known as layering—there

was no question about that. After a while, if they had time, they would pass through one another—diffuse through one another—and then the mixture became homogeneous. But there was no doubt that, if they put into a holder a heavy gas and then a light one, they would have layering, but only for a time. He maintained that gases once mixed could not separate. Then as to the quality of the gas. In Belfast it was 25 candles; but they might turn out an 18-candle, a 30-candle, or even a higher quality gas. It was simply a matter of the quantity of oil they put in. That was one of the advantages of the process. In Mr, Bell, he had a more serious antagonist to attack. But, in the first place, he thought that gentleman was wrong about asphyxiation. He believed it required a very strong man indeed to stand oil gas. He (Professor Macadam) was in the same position as that referred to by Mr. Bell. Coal gas did not affect all to the same extent; but the gas from paraffin was a totally different matter, because it contained an amount of sulphuretted hydrogen. In this they had an altogether new element introduced, and a very poisonous gas. Therefore he was not at all astonished at Mr. Bell's statement. In fact, he had himself seen men affected by paraffin oil gas. Coal gas did not affect himself; but he did not think this had anything to do with the poisonous property of carburetted water gas. If a man took 2 per cent. of prussic acid, it was poisonous; if he took 100 per cent., it was more poisonous. But he did not think it mattered to the man whether he was killed by 2 per cent. or 100 per cent., as they were both certain to kill him. To breathe 5 per cent. of carbonic oxide was poisonous within five minutes, let them mix any way they liked. Carbonic oxide was the most poisonous gas they had at present, and if they took an ordinary coal gas, with a mixture of 10 per cent. of carbonic oxide in it, it was much over the poisonous quality. By most people, a very much less percentage of carburetted water gas than of coal gas was noticeable by the odour of it. He did not, however, take exceptional noses such as Mr. Bell had mentioned. Therefore he considered that carburetted water gas could not be held to be more dangerous than coal gas. Mr. Wilson had used the words "water gas." But he must again draw their attention to the difference between the two gases—water gas and carburetted water gas.

Mr. Wilson: I intended to speak of carburetted water gas.

Professor Macadam: Then I have simply again to try to force upon the meeting the absolute necessity there is nowadays, with two distinct processes, of using the terms correctly.

The President asked for a hearty vote of thanks to Professor Macadam; and this was accorded.

KEITH'S AUTOMATIC AIR AND GAS COMPRESSORS.

Mr. George Keith, jun. (London), read the following paper, prepared by his father, Mr. James Keith, illustrative of Keith's automatic air and gas compressors, an exhibition of which was given on the platform:—

Ever since the introduction of high-pressure incandescent gas-lighting in Belgium by the Somzée-Greyson Company, many attempts have been made to produce an apparatus for compressing ordinary coal gas taken from the street-main, and supplying the gas so compressed regularly and steadily to the burners and mantles in use. Naturally, water-pressure, or water-power, has generally been applied for the working of the gas compressors produced; but the cost of water under pressure being considerable in most towns and cities in the United Kingdom and elsewhere, the game, after all, was scarcely worth the candle, unless such machines could be made to work efficiently and economically with a low water pressure or with a water cistern on a second floor, and above all, automatically, and this is what has never been done until Keith's Automatic Air and Gas Compressors came upon the scene.

This invention (illustrated by one of the machines on exhibition), is worked by the ordinary water service, either from the street main or from a cistern; is absolutely automatic in action; acts as a governor as well as a compressor; uses an infinitesimal amount of water (only from about one to one-and-a-half gallons per hour for every ten cubic feet of air or gas compressed); meets with the approval of the water companies; is silent in operation, and has practically no visible movement; is devoid of friction in the air and gas-pump portions, which require no leathers nor packings nor oiling; can be placed almost anywhere with safety; gives a steady unvarying pressure of air or gas without any pulsation on either the inlet or the outlet side; and is acknowledged to be the most compact, economical, and perfect apparatus of the kind.

For high pressure incandescent gas lighting, or for the compression of air and the supplying it under pressure for the better combustion of acetylene gas, Keith's apparatus mentioned stands unrivalled; and the cost of water for working need not be taken into account, as, even at the high price of water in London, the cost only amounts to about 1d. for every 1000 cubic feet of gas or air compressed and used, while the apparatus being entirely automatic, the whole action starts or stops on the mere turning on or off of the gas or air taps at the burners. The apparatus is at present made in two sizes, which are of different construction; but in both the principle is essentially the same. They consist of a reciprocating water-motor, acting directly on a practically frictionless, double-acting pump, which takes the gas from the main, and forces it into a small holder weighted to the desired pressure, which, in the case of the Somzée-Greyson burners, is from 7½ to 8 inches water gauge. This holder is arranged so as to control the water supply to the motor—shutting it off when rising, and opening it when falling. In the case of the small machine (one of which is shown on the platform, and which is arranged to supply from 100 to 150 cubic feet of compressed gas per hour), the pump and motor parts are enclosed by the weighted holder; while in the larger apparatus, which will supply from 300 to 500 cubic feet per hour, the holder floats in a tank alongside the pump and motor portion, but on the same base. In all other machines for the same purpose, the principal trouble has been experienced with the pump portion; the work done in overcoming the friction of the pistons and glands of which amounted to considerably more than the actual work performed in raising the pressure of the gas, even when kept well lubricated and fairly slack, to say nothing of the trouble arising after being in use for a time, owing to leakage of gas at the glands and pistons, and the clogging up with dirty oil. All these troubles are overcome in the Keith apparatus, by using, instead of a fitted and packed piston, a small holder or bell, working in a deep annular water seal. This gives at once an absolutely tight piston, with no friction, and requiring no lubrication or cleaning whatever. The top and underneath portions of the pumping-bell are each connected to suitable inlet and and discharge valves, so arranged as to make it double acting. In the case of the water-driven compressors, the discharge of the motor is arranged to pass through the seals and keep them overflowing; and from thence into the holder seal, before being run to waste. It will at once be seen that, by doing away with the friction of the piston and glands of the pump, the power required to do the work of raising the gas pressure is reduced to the minimum.

As is now well known, gas burned under the high-pressure incandescent system at from 8 to 10 inches water-gauge pressure, gives about 30-candle power for every cubic foot of gas consumed; so that the smaller size apparatus exhibited is capable of furnishing about 4500 illuminating candle-power, while the larger apparatus is capable of furnishing about 15,000 illuminating candle-power, at a cost, for gas, of 150 and 500 cubic feet per hour respectively, and at the merest trifling cost for working by water. Unlike other arrangements for a similar purpose, the apparatus described is entirely free from smell, noise, and irregularity in working. These figures apply to the use of 16-candle power London gas; and, without doubt, the results would be even better with Scotch gas.

Keith's apparatus is being used preferentially by the Intensified Gaslight Company, Limited (Somzée-Greyson system), by the Welsbach Incandescent Gaslight Company, Limited, and by others, for their high-pressure systems of gas lighting. The plant is in use for lighting the large lamps in front of the London Pavilion, Piccadilly, the Metropolitan Music Hall, Edgware Road, and elsewhere in London and the Provinces.

The foregoing description applies to the gas-compressors worked by water pressure. Very often, however, water pressure is not available, or it is, perhaps, inconvenient or expensive to apply water power to such mechanism; accordingly, under recent developments, the same end can be attained without the adventitious aid of water, as is illustrated by the latest form of the Keith's apparatus shown at work on the platform—the power for working the apparatus being wholly obtained from the heat of a gas-burner (as demonstrated).

The small apparatus shown working in the manner described, without the use of water pressure, but by power developed in a little hot-air motor, merely from the heat of a bunsen burner consuming a few feet of gas per hour, is capable of supplying (say) 15 Somzée-Greyson burners, each consuming 10 cubic feet of gas per hour; and each burner gives a light of 300 candles (as is so practically illustrated on the platform), and is the perfection of simplicity in power development from the gas itself, and in the working mechanism.

Of course, the working mechanism of the compressor may be driven by any other mechanical power—such as electricity, a running shaft, or any other power available—in a manner somewhat similar to that of driving it by the hot-air motor. The result, so far as the invariable pressure obtained (whether the full number of burners be turned on or not), and the perfect automatic action of the compressor itself, is the same as with the apparatus shown at work, or with the compressors worked by water pressure previously described.

It may be explained that while the automatic action of the water-driven and hot-air driven machines is due to the rising and falling of the loaded gasholder into which the gas is compressed, and the result—perfect automatic regulation—is the same, there is a difference in the way this is brought about. In the case of the compressor worked by water motor, the water pressure actuating the motor is externally turned off or on by the variation in level of the loaded gasholder—the dropping of the gasholder turning on the water. In the case of the compressor worked by hot-air motor, it is the gas itself which is controlled by the rising and falling of the loaded gasholder; the rising of the gasholder beyond a certain level practically stopping the inlet of the gas from the main to the compressor valves, and enabling the compressed gas inside the apparatus to be circulated by the compressing bell—any additional gas from the main being admitted automatically as it may be required.

The apparatus is also suitable for automatically increasing the pressure of gas in buildings or districts where an exceptionally low gas pressure prevails; compressing oil gas, acetylene gas, air, &c., and supplying these without variation at the increased pressure; making and supplying air gas; and (by another modification) compressing and mixing air and other gases in measured, regular, and unvarying proportions.

Keith's automatic compressors can be made of any size suitable for any requirements; and when used automatically for increasing the gas pressure on special buildings, or in low-lying districts, they can be made in duplex form, so far as the pumping or compressing parts are concerned, in order to give increased efficiency and simplicity—the two or more pumps working into one large holder.

The "JOURNAL OF GAS LIGHTING" lately described the construction and action of Keith's automatic compressors, and their suitability for increasing pressure.*

The burners exhibited in connection with the apparatus are the Somzée-Greyson burners, which, up to the present, are undoubtedly the best burners for high-pressure incandescent gas lighting. The mantles for these burners are specially prepared by the Welsbach Company, and are extra strong; and, although they might, with profit, last longer, these mantles sometimes last with apparent full efficiency for six months or more. Undoubtedly, the higher pressure of the compressed gas, and the air induction passing through the mantles, blow off the burnt dust or carbon, and tend to harden the framework and prolong the life of the mantles.

The conclusion that there is a bright future opening before the principle of high-power gas lighting, appears to be quite irresistible; and those gas corporations and companies who give this system of lighting most encouragement, as well as those incandescent gaslight companies who decide to make the system a speciality, will, under proper conditions, before very long reap a rich reward.

Discussion.

The PRESIDENT was sure they were all very much indebted to Mr. Keith for showing his apparatus; and, personally, he was very glad that he had brought the apparatus worked by hot air. He thought it was to be preferred to the hydraulic machine, because it put the whole system under gas, which was of very great advantage to them.

Mr. A. BELL (Dalkeith) asked at what pressure the gas was going into the burners.

Mr. KEITH: 7½ inches.

Professor MACADAM said he should be very much obliged if the reader of the paper would give them some information as to the constitution or composition of the mantles which he had shown, and which, as he had told them, would last for six months with unimpaired luminosity; because it was well known to those who had used the mantles of any Company—and more so of the Welsbach Company—that there was a very great loss of luminosity. If, therefore, the Welsbach Company had now been able to bring out a mantle which would not be affected by long use, but would rather be improved, then they had certainly solved a very great difficulty. He had had considerable experience with Welsbach burners, and he was not perfectly clear that there was very much saving in cost in using Welsbach burners, because what saving there was in gas was lost in the cost of extra mantles. He had been balancing up the accounts of his house very carefully; and beyond the fact that there was increased luminosity (which, he admitted, was a considerable matter), there was not much saving. He should like to know what the composition of the improved mantle was; and if it were patented, the number of the patent, so that he might be able to find out its composition.

Mr. T. DOUGLAS HALL (Montrose) said he would like to ask a very simple question. The pressure, at that moment, was 7½ inches, what was the consumption at the point of combustion? Did the increased pressure increase the consumption at the point of combustion?

Mr. A. MACPHERSON: Perhaps Mr. Keith will tell us what amount of gas is being consumed in the motor.

Mr. KEITH did not think he made the statement that the mantles shown were improved by being kept burning. The statement he did make was that the mantles did not lose their luminosity so soon as they appeared to do under ordinary conditions; because, for one thing, they never got smoked. He could not give Professor Macadam the composition of the mantles. He did not profess to know anything about the mantles; the only thing he professed to know about was the machine he used. But certainly, from his own experience, he found that, when he got a good mantle, it would last a very long time. He only had the authority of the Welsbach people themselves for saying that the high pressure had the effect of hardening the mantles. There was one thing, though, that while the mantle did last, they were getting a great deal more out of it; they were getting (say) 300 candles out of one of these mantles, as against the usual 60 candles. The mantles cost, perhaps, 1s. 6d. each, as against the ordinary-sized mantles at 1s. each; and, supposing a mantle to last only a quarter of the time with high pressure, they would be getting value out of it all the while. About the consumption of the burners at low pressure, he would hardly like to say, because it would vary very much with the pressure at the time, and he had not figures to work upon.

Mr. HALL: I do not think Mr. Keith has exactly understood my question. I want to know the consumption at the ordinary pressure, and under the 7½ inches of pressure.

Mr. KEITH said that, with London gas, the consumption at high pressure was 10 cubic feet. It might be a little more with Scotch gas; but they were getting 300 candles.

Mr. BELL: Is that without variation of pressure?

Mr. KEITH: Without variation. The real secret of it was that, by increasing the pressure of the gas, more air was drawn in at the burner; and it was found that, with 16-candle gas, five to one gave the best results. They might burn more gas, by making it four to one. It was a question, with richer gas, whether they could not reduce the nozzle; and in this way mix more air with the gas. He had experimented with mixtures above five to one—as much as eight to one; and at eight to one he got no luminosity at all. There was so much air in the gas that there was not sufficient heat to heat up the mantle at all.

Mr. M'GILCHRIST: What is the consumption of gas under the present conditions? and what would be the consumption under the increased pressure? At the present time, with a Welsbach light, there is a consumption of something like 3½ or 3¾ cubic feet. What extra gas is consumed by the increased pressure?

Mr. BELL: Has that ever been tested by meter?

Mr. KEITH said it had; but he could not then give the actual result. All he could tell them was that, of course, they could not compare the burner he had shown with the ordinary incandescent burners at all. As it was burning before them, it was not getting the full efficiency of the extra pressure. One of the greatest advantages of the apparatus shown was that, if anything should go wrong with the machine, or anything else, the gas went through at the ordinary pressure, and they got some light; they did not go into darkness. The apparatus was not meant for a low pressure; it was intended for a high pressure and nothing else. They could not get at what the consumption of gas would be with a low pressure.

VOTES OF THANKS, ETC.

The PRESIDENT said they had had very good papers from Mr. Yuill, Professor Macadam, and Mr. Keith; and he thought they all deserved a very hearty vote of thanks, which he had great pleasure in proposing.

Mr. T. WILSON (Coatbridge), the Past-President, said he had a very pleasant duty to perform, in presenting to Mr. Pooley, the Presidential Medal. He hoped it would keep Mr. Pooley in mind of as successful a meeting as the Association had ever had; and he trusted that Mr. Pooley would be long spared to wear it.

The PRESIDENT thanked Mr. Wilson, and all of them, for the medal, which he should prize very much indeed. When they elected him President, he did not at all relish the position; but he had been very much helped through with the business that day by their indulgence. He should keep the medal as a memento of this most successful gathering.

Mr. EWING proposed a vote of thanks to Mr. Carlow for the excellent way in which he had carried on the Association during the year, and for his assistance in the conduct of the business that day.

Mr. CARLOW said the work of the Secretary was certainly very great at all times; but he was amply repaid when he saw the members turning out in such large numbers. One thing he would say, that this year he had had much more difficulty in persuading members to come forward and give papers for the meeting. Unless it had been for the kindness of Professor Macadam and Mr. Keith, the meeting would not have been so successful as it had been; and he would impress upon the members—more especially the younger members—their duty of coming forward to take part in the work of the Association. Unless they did so, the work for which it was established would come to a standstill. So far as he was concerned, he would spare himself no labour in conducting the affairs of the Association; but he had a feeling that as he had been Secretary for over twelve years, he should resign the secretaryship now, and let a younger man take the reins. He would now give intimation of his intention, so that next year, in the ballot-paper, they might substitute another name for Secretary; and he should be very willing indeed to give the new comer every assistance he could.

Mr. M'GILCHRIST believed he represented the views of the members generally when he expressed the opinion that if Mr. Carlow thought he had not got very good masters, they knew that in him they had a very good servant; and they hoped the day was far distant when Mr. Carlow would leave his post.

Mr. YUILL said that perhaps they were not all aware of the amount of labour and trouble Mr. Smith, of Stirling, had had in arranging for the meeting; and he thought they ought not to leave without according to Mr. Smith a hearty vote of thanks for the trouble he had been at in trying to accommodate them that day.

Mr. SMITH, in a word, returned thanks.

This concluded the meeting.

The members and friends, at a later hour, dined together in the Station Hotel—Mr. POOLEY again presiding. A short toast-list followed.

* Descriptions of Keith's apparatus will be found in Vol. LXXIII., p. 1363, and in the number for July 4, p. 37.—ED. J.G.L.

On Friday a most delightful excursion, attended by over 150 persons, took place from Stirling to the charming district of the Trossachs. Among the guests present were the respected father of the President. After a visit to the lower end of Loch Katrine, luncheon was served in really first-class style in the Trossachs Hotel. On the return journey tea was partaken of in the Dreadnought Hotel, Callander; and on the platform of the railway station there, the assemblage may be said to have dispersed. The weather was fine; and this, added to the fact that the leafy landscape is at its best in the Highlands, helped to make a most enjoyable holiday.

WESTERN (U.S.A.) GAS ASSOCIATION.

Annual Meeting at Milwaukee.

(*Continued from p.* 235)

The Editor of the "Wrinkle Department," Mr. E. J. Jenkins, presented his report, commencing with a device contributed by Mr. E. Printz, of Zanesville, for handling retort lids, which comprised, in addition to a luting table with a shelf under it for receiving prepared lids, two pairs of brackets made of flat bar iron, bolted to upright scantlings fixed to the wall, so as to hold the brackets at a convenient height. Each pair of brackets would take about six lids. Mr. F. Egner sent a description and illustration of a bye-pass for the hydraulic main seal, being a connection made of 1½ or 2 inch wrought-iron pipe, from the dip pipe to the top of the hydraulic, and fitted with a cock, so that by opening the cock the gas could pass direct to the hydraulic without going through the seal. This device was especially recommended in connection with the use of oil for enriching. Two forms of tar overflow from the hydraulic, by Mr. V. L. Elbert and Mr. W. H. Odiorne, respectively, were described. The last named also sent a drawing showing where a cleaning door would be found useful for cleaning or removing deposits from the pipe leading from the carburetter to the seal box in water-gas plant. Mr. Donald M'Donald recommended a test light under regular pressure for indicating the quality of the product during the water gas "run;" and he described an apparatus, including a small bell governor, for securing this result. Mr. B. E. Chollar described a rough quantitative test for use in connection with an oxide purifier. A stream of the gas to be tested is caused to bubble through a solution of permanganate of potash—say 2 grains to the quart; a device similar to the tubes in the Harcourt colour test being used. The liquid is decolourized in more or less time according to the proportion of sulphuretted hydrogen present in the gas. Mr. S. F. Hayward recommended spreading oxide for revivification on old purifier-grids supported some inches above the ground, instead of on a solid floor. Mr. O. O. Thwing proposed that pressure register sheets should be marked with a blue line showing the desired degree of pressure, as a guide to the man in charge. An ingenious device for transferring the rising of a water-gas relief holder to an ordinary index, by means of a cord, drum, and train of wheels, and thus approximately indicating the make of gas, was supplied by Mr. T. D. Miller.

The Committee on "Isolated Benches for Regenerator Firing" presented three separate reports. Mr. W. E. Steinwedell, of Quincy (Ill.), read the first, giving an account of Oechelhaeuser's system, as in use at Erfurt, Germany. The cost of two benches of eight retorts each and one generator, but exclusive of pit, was £775; and the consumption of fuel 16 lbs. of coke per 100 lbs. of coal carbonized. But he considered that some other systems having generators in front of the stack worked better, such as the Hasse-Didier, which was in use at Leipsic and giving excellent results, because they warmed the secondary air supply to a greater extent. These had closed generators, and only used 14½ to 15 lbs. of coke per 100 lbs. of coal carbonized. The same furnace was used in connection with inclined retorts. One of the most modern settings in Europe was similar to the construction employed by Joly and Kloenne; the leading features being an inside generator to every bench, with furnace doors at the back. It was full depth with nine retorts in each arch; and the cost was about £600 per arch with ironwork complete. The average of daily practice was 14 lbs. coke per 100 lbs. of coal. The author expressed preference for a separate generator and hydraulic to each bench.

Mr. Fred. Bredel, of Milwaukee, read the second report. It commenced by describing the Siemens system as tried in London and Paris in the early seventies. The practical results were, however, far below those obtained with regenerator furnaces where each bed had its own generator. But even at that time, the Mueller Eichelbrenner system gave better results than the Siemens. He claimed that isolated generators were more expensive in first cost and in fuel consumption, and were not so reliable as independent generators; and he went on to give a description of a plant on the isolated system which he had erected at Erie (Pa.), where cheap coal fuel could be obtained, and he had hoped it would pay. Adjustment of the outlet damper did not mean adjustment of the heats, which varied in a perplexing and unaccountable way according to the pressure in the generator. Attempts to adjust the supply at the inlet to each bed were equally useless; and the heats could not be depended upon from day to day. Trouble with tar and soot led to the substitution of coke for the coal fuel, and with this rather more regularity of heat was obtained; but the fuel results were nearly 20 per cent. more than with a good regenerator setting. He next introduced plenty of cleaning doors in the generator and main flue, and thus was able to get better working; but the lesson he learnt was that if coal was to be the fuel, the gas must be cooled and scrubbed before being admitted to the settings. Altogether, he strongly recommended independent generators, whether coal or coke was to be the fuel. Initial flame temperature was of more importance in connection with heating retorts than quantity of heat, because all the heat below 2000° Fahr. was useless; and therefore the bench that gave the highest flame temperature would be the most economical. It was true that the isolated generator had been successfully adopted in steel works; but the conditions of working were very different. In order to get anything like an even production of gas, at least two generators must be used; so that when one was burning low the other might be burning high, and if one generator required repair, both would have to stand off. After making inquiries at several works where isolated furnaces were employed, he could not say that he had received one favourable report on the system. Mr. W. Foulis, of Glasgow, had spoken very hopefully, three years ago, of a trial made at Dawsholm with three generators outside the retort-house applied to a bench of sixteen beds of twelves, or 192 retorts in all, which were worked for one winter with promising results. But the author had heard nothing further of this arrangement; and was inclined to doubt its ultimate success. In referring to results obtained in Germany or Great Britain, it must be remembered that the German, and some of the British, coals were easier to carbonize, and did not require the temperatures necessary when working American coals. He produced two tables showing coke made per 100 lbs. of coal, and coke used for firing: (1) From 18 German works where outside generators were used; and (2), from 8 German works where inside generators were used, which showed a considerable advantage for the inside generator.

Mr. Irvin Butterworth, of Columbus, read the third report, in which he did not go so far as his colleagues in condemning the isolated generator. Several arrangements on this system had been put in operation with reasonable success. Mr. Foulis, Mr. C. C. Carpenter, and other eminent engineers had full confidence in its future; so he was inclined to think that the difficulties were simply those incidental to the introduction of any new principle, and that it was well worthy of further experiment and development.

The Chairman having opened the discussion, Mr. Bredel said he understood Mr. Butterworth had accepted a place on the Committee at a late date in the room of Mr. Chollar, and that his report was simply the commencement of a discussion on the other two. He (Mr. Bredel) claimed to have shown that the isolated generator was theoretically an impossibility, and to have supported this conclusion with practical data. Mr. Butterworth produced no evidence whatever in support of the views he had expressed. Mr. Doherty disputed the conclusions arrived at by Mr. Bredel, who had really shown that an economical isolated generator was quite possible in theory. It had not been proved that the isolated generators must of necessity require more fuel or cost more than independent generators; and if they did use more fuel, they might carry with them a more than compensating saving of labour. Mr. Bredel's views might apply to the question of outside *versus* inside generators for one bench only, but not to one outside generator for several separate benches. They were not justified in assuming that the gaseous fuel must be cooled and scrubbed. Then he had heard nothing as to the saving in wear and tear of retorts and settings, secured by doing away with the opening of the furnace doors and admitting cold air. Some of the difficulties in the Erie plant were due to the mistake of introducing the soft coal to the generator in heavy charges; whereas fuel of this description required to be fed in steadily, by a worm or something of that sort. A high flame temperature was not necessarily the most economical, because the retort-benches required a distributed, and not a concentrated, heat. In many settings a quantity of steam was used with advantage (although it reduced the flame temperature) as an aid to uniform distribution. He argued that the cost of repairs would be less with the isolated generator. Then the loss of heat by cooling and scrubbing the fuel gas was not an enormous quantity, being something under 10 per cent.; and the recovered bye-products would more than pay for this. He believed that in most of the systems described by Mr. Bredel the primary air supply was not heated, which was an important omission; and he claimed that if the steel men could make isolated generators a success, the gas men could do so. Ordinary houses could be warmed throughout by a stove in the cellar with more efficiency and economy than by means of a stove in each room; and the retort-house furnaces could be similarly treated. The loss of heat from 100 feet or 600 feet run of flue was an inconsiderable quantity. Perhaps some of the isolated generators were not a success. The first clay-retorts, large gasholders, and many other things, were open to the same objection. But a few failures did not settle the matter. The fuel consumption in the retort-house was an important item, worthy of careful attention; and every possible means of reducing it should be encouraged. The isolated generator enabled fuels to be used that did not cost perhaps one-fourth

the price of coke. In concluding, he urged that the subject should receive further attention, and admitted that, while Mr. Bredel might be rather prejudiced against the isolated generator, he (Mr. Doherty) might err in the opposite direction.

(To be continued.)

GAS PURIFICATION, WITH RECOVERY OF BYE-PRODUCTS.

By Dr. J. Bueb.

The following is an abstract translation of the paper, on "Gas Purification, with Recovery of Bye-Products," which was read by Dr. J. Bueb, of Dessau, at the recent meeting of the German Association of Gas and Water Engineers. In our notice of the proceedings at that meeting (*ante* p. 107), we indicated the great interest which the paper excited, and we hope to give shortly a *précis* of the vigorous discussion which ensued on the reading of the paper.

It is continually put forward as a great advantage of water gas manufacture, said the author, that it yields no bye-products. In these days, therefore, when water gas is gaining ground in the gas industry, it becomes peculiarly appropriate to point out clearly that bye-products are not the failing, but rather the strength, of coal gas manufacture. In the economical production of illuminating gas, the bye-products are of the utmost importance. They form the raw materials of two great industries which have assumed immense proportions, in Germany especially—viz., the organic colour industry and the artificial manure industry. In the universal endeavour to render the soil more productive, the gas industry lends valuable aid by supplying ammonia, which year by year replaces more and more foreign saltpetre (nitrate). It is the mission of gas-works' chemists to see that the purification of the gas and the recovery of bye-products are carried out in such a manner that the purification is as nearly complete as possible, and the bye-products are obtained economically in the most valuable form. The object of this paper is to throw out some hints on these matters.

The carbonization of coal yields as bye-products, coke, which remains in the retort, and tar, naphthalene, ammonia, sulphuretted hydrogen and cyanogen, which escape with the crude gas, and must be subsequently removed in a proper manner. With regard to coke, the gas manager is not in a position to improve its quality unless he is able to control the quality of the coal at his disposal in respect of the amount of ash it contains. The ash of the coal passes wholly into the coke, and is twice as harmful in it as in the coal. Breaking the large coke reduces the proportion of ash in the saleable coke, because the breeze formed contains as much as 50 per cent. of ash. Coke breeze, at one time an almost valueless product, has, by the aid of forced draught, now been made to furnish nearly the whole of the steam required on gas-works.

The quality of the tar produced cannot be greatly modified. The description of coal carbonized, and the temperature of the settings, are the two factors which affect the quality of the tar. The introduction of high heats, which now is rightly regarded as an advance in gas manufacture, owing to the general use of the Welsbach burner and the cheapness of enrichment, has been attended with an all-round drop in the quality of the tar. The proportion of readily boiling hydrocarbons in the tar has diminished, while that of naphthalene and that of hydrocarbons of high boiling point have increased. The amount of water mechanically retained by the tar has also grown; so that the tar, owing to the large percentage of water in it, is not readily saleable at the gas-works. On this account, attempts have lately been made to rid tar of water by centrifugal machines. The author's experience enables him to state that such machines afford an excellent means of removing water from tar; and that, with proper manipulation, they reduce the amount of water to 2, or at the most 3 per cent. of the tar.

Naphthalene is associated with the tar, and makes its appearance in greater or smaller quantity as soon as the tar is abstracted from the gas. So long as the tar remains in the gas, it appears to have a solvent action on the naphthalene; but when the tar is removed, the naphthalene separates in scales on the sides of the mains, and, especially when the temperature drops, causes the well-known blockages of the latter. Nothing has so far been achieved towards preventing the production of naphthalene in the retort; and it is scarcely to be expected that attempts in this direction will prove successful. Until recently, also, endeavours to separate the naphthalene from the gas at the works have not led to any practical result on a large scale. Hitherto, the rapid removal of existing naphthalene stoppages has been aimed at in most cases.

The German Continental Gas Company have given attention for some time to this matter, and have made a number of experiments. At Dessau, a process devised by Professor Erdmann, of Halle, was tried. It consisted essentially in the removal of naphthalene by a purifier charged with sawdust which had been saturated with an alcoholic solution of picric acid. This acid formed naphthalene picrate with the naphthalene; and the removal of the latter from the gas was undoubtedly accomplished. The method could not, however, be employed on a large scale, as the cost of the apparatus and working was unreasonably high. Experiments were then made in another direction; and a new method for the removal of naphthalene actually appeared to have been discovered. But when a patent for the new method was sought, the German Patent Office informed the applicants that the process had already been patented in England by William Young, in 1897. This process consists in passing the gas through a suitable scrubber or washer containing oil which will dissolve naphthalene.

In the Dessau experiments, ordinary heavy coal-tar oil, to which 3 per cent. of benzol had been added, was used. This mixed oil does not deteriorate the illuminating value of gas which is passed through it; while it absorbs the naphthalene in the gas. The oil continues to absorb naphthalene until it contains as much as 15 per cent. It is then saturated and unfit for further use. A standard or Ledig washer practically answers well, and it need be only of half the dimensions of the ordinary washer. Any scrubber in which the oil could be continuously circulated would, however, serve for the process. The saturated oil from the washer is run into the tar-tanks, provided there is no special use for it. The cost of the method then is given by the difference between the buying price of the oil and the selling price of the tar, and amounts to only a few shillings per 25 gallons. For example, at Dessau 706,000 cubic feet of gas were freed from naphthalene by means of 176·4 lbs. of tar oil. The oil had absorbed about 10 per cent. of naphthalene; and, therefore, there must have been about 200 grains of naphthalene present in 1000 cubic feet of gas. The cost of the purification was as follows:—

176·4 lbs. (80 kilos) of tar oil at £3 per ton	4	9
5·3 „ (2·4 „) „ benzol at £12 10s. per ton . .		7
Total .	5	4
There were obtained 198·4 lbs. (90 kilos.) of oil saturated with naphthalene = tar at £1 10s. per ton . . .	2	8
Net cost =	2	8

The net cost was therefore equivalent to 0·045d. per 1000 cubic feet of gas dealt with. The method was tried with a small "Standard" washer; but a naphthalene washer has now been ordered for the Dessau gas-works, which will be ready for use next winter. It is to be placed immediately after the Pelouze tar extractor.

The recovery of cyanogen, a bye-product which hitherto has been obtained incidentally in the course of the purification of the gas from sulphuretted hydrogen, may next be dealt with. It is not long since the spent purifying material which had previously been regarded as refuse or ballast, began to be recognized as useful. It was observed that the oxide had amassed not only sulphur, but the valuable body cyanogen, during its use in the purifiers; and this observation was rapidly followed by the elaboration of technical processes for the recovery of the cyanogen from the spent oxide, and the production from it of commercial yellow prussiate. The demand for this product was, however, very limited until, as the raw material for the manufacture of potassium cyanide, it was required in large quantities to supply the cyanide needed for the extraction of tailings in the gold-fields of the Transvaal. Then the spent oxide became a valuable and readily marketable bye-product of the gas industry. Soon, however, spent oxide no longer sufficed to supply cyanogen products in quantity equal to the demand for them, and other sources of cyanogen were eagerly sought. In the gas industry, it was recognized that the cyanogen recovered from the oxide represented only a fraction of the cyanogen generally present in coal gas. A part had been earlier absorbed in the ammoniacal liquor; a part had been converted in the oxide into useless sulphocyanide; and a third part remained in the purified gas and corroded the plates of gasholders and meters, and rendered the water in the tanks of the holders poisonous. The manner in which it was possible to recover the whole, or at least the greater part, of the cyanogen of the gas was soon discovered, as the old patents of Knublauch, Rowland, &c., prove; but such processes do not appear to have been practically applied on gas-works in Germany. In this matter, the German gas industry was left in the background by the English; though in England the value of the cyanogen in the oxide had not been so soon recognized. Some years ago, however, at English works processes were introduced for the extraction of cyanogen from the gas, in the so-called wet way, before its entry to the purifiers. The increased make of cyanides, especially when the Gaslight and Coke Company took up the process at their works, became so considerable that over-production ensued, and prices of cyonogen products were much depressed. At the meeting of the Incorporated Institution of Gas Engineers in London in 1897, Mr. G. P. Lewis read a paper in which he described the new method of recovering cyanogen from gas,* and Mr. W. Foulis, at the same gathering, gave particulars of his process for the extraction of cyanides from gas.† The processes described by these two English gas engineers consist essentially in passing the gas, as it leaves the scrubber, through a suitable washer in which it is brought in intimate contact with alkali and a salt of iron. Both Mr. Lewis and Mr. Foulis laid great stress on the importance of the complete removal of ammonia in the scrubber prior to the absorption of the cyanogen by the salt of iron. That Mr. Foulis still holds the view that the previous removal of ammonia is a *sine quâ non* of successful cyanogen recovery, is

* See "Journal," LXIX., p. 1049. † *Ibid*, p. 1053.

shown by his recent address at the Conference of the Institution of Civil Engineers.* He said, in reply to the discussion on his address: "With regard to the best position of the plant for the extraction of cyanogen, I find that it is after the ammonia purifiers—after the gas has been freed from every trace of ammonia."†

At the time that the papers referred to were being read in 1897, cyanogen was also being obtained in large quantities from residual products at the Dessau sugar-refinery. According to a process patented by Dr. Reichardt and the author (see English Patent No. 7177 of 1895), the beetroot molasses, and residues were gasified in closed retorts; and the gases obtained were heated to a given temperature at which formation of cyanogen took place. In elaborating this process, it appeared that it was possible to utilize ammonia under certain conditions for the production of cyanogen; and it was not a great stride to apply this discovery in the gas industry as well as in the sugar industry. At the Dessau Gas-Works surprisingly good results were secured; and to-day the process has been in use for more than a year at five large gas-works—viz., Frankfurt-on-Oder, Potsdam, Dessau, Erfurt, and Warsaw.

In contradistinction to the English processes, in which, as has been already stated, the previous removal of ammonia is considered a *sine quâ non*, this process recovers the cyanogen by the help of the ammonia, and at a stage in the manufacture of the gas when all its cyanogen is still present in it. It not only gives a higher yield of cyanogen than the English processes, but it possesses the great advantage of needing no expensive alkalies, such as soda or potash, for the absorption of the cyanogen, since the absorption is effected by the ammonia present in the gas. The process consists essentially in leading the gas direct from the Pelouze tar-extractor into a mechanical washer, in which it is brought into intimate contact with a concentrated solution of a salt of iron, without any addition of alkali. The cyanogen there unites with a part of the ammonia in the gas, and with the salt of iron, and forms an insoluble double salt, which leaves the washer in the condition of thin mud. The absorption is complete, and the yields at the various works where the process is now used on a large scale are equivalent to from ¼ to ⅜ lb. of yellow prussiate per 1000 cubic feet of gas; the quantity varying between these limits according to the description of coal that is carbonized.

The process gives no trouble on the gas-works or in the vicinity thereof, as it entails no chemical manipulation of the liquid on the works. The ammonia which is not utilized in the absorption of the cyanogen passes on with the gas, and is absorbed in the ordinary ammonia scrubbers, the work of which is greatly relieved by the cyanogen washer. An important indirect advantage of the process is that the removal of sulphuretted hydrogen is greatly assisted. Formerly the ferric oxide was to a considerable extent used up by the formation of prussian blue; but now, where the cyanogen process is in use, no cyanogen enters the purifiers to form prussian blue with the oxide, and the whole of the latter is available for the absorption of sulphuretted hydrogen. At the works where the process has been adopted, it has been observed that the work of the purifiers has been much relieved. The spent oxide can be readily obtained with as much as 50 per cent. of sulphur (on the dried sample); and is no longer valueless, unless it contains prussian blue, but can be sold with advantage simply for the manufacture of sulphuric acid. The process can be adopted wherever standard or Ledig washers are in use, by simply appropriating the first chambers to cyanogen extraction. But, wherever possible, it will be found advantageous to set up special apparatus for the absorption of the cyanogen, as the greater yield will in a very short time repay the outlay.

The process for the absorption of naphthalene by tar oil, described earlier in this paper, may be worked very nicely in conjunction with the cyanogen recovery process, by using the first half of the washer for the extraction of naphthalene, and the last half for the cyanogen process. Another advantage of cyanogen recovery is that the gas as distributed is free from cyanogen; and the process thus is, in effect, an improved method for the purification of gas. The introduction of the new process at a gas-works changes the order in which the several pieces of apparatus have been hitherto usually placed. Where both water and atmospheric condensers are used, they should be separated. The atmospheric condenser should be immediately followed by the Pelouze tar-extractor, which has been proved to act equally well with the gas at 85° to 105° Fahr. as at ordinary temperatures. The naphthalene and cyanogen washer should follow the Pelouze extractor, and next should come the water condenser and the ordinary ammonia washers or scrubbers. This arrangement of apparatus has the advantage of causing the gas to enter the ammonia scrubber in a perfectly cool state, which, as is well known, is an essential condition for the complete absorption of ammonia. If, on the other hand, a considerable length of main or other apparatus exposed to the atmosphere, intervened between the water condenser and the ammonia scrubber, then in summer the temperature of the gas entering the latter would be raised to that of the atmosphere, which frequently is nearly 20° Fahr. above that of the water in the condenser, and of the gas issuing from the latter. The scrubbers which are most efficient for the complete absorption of ammonia are mechanical washer-scrubbers of "Standard" or Ledig type. The water used in the scrubbers must not be hard; and, in particular, it must not contain considerable quantities of gypsum, as hard water causes incrustation on the surfaces within the scrubber, and this interferes with the proper action of the scrubber, and throws an increased pressure. If hard water only is at hand, it should be subjected to a softening process before it is used in the scrubbers.

The purifiers should, as at present, come next to the scrubbers. The vessels should be provided with pipes for maintaining them in winter at a temperature about 2° above that of the incoming gas. If they are allowed to remain at the prevailing winter temperature, the gas issuing from the scrubbers, saturated with aqueous vapour, will deposit water on the purifying material as it enters the cold purifiers, and will convert the first layers of the material into a pasty mass which will throw great pressure. The author's experience is that it answers best to let the gas enter at the top and leave at the bottom of the purifiers, instead of the converse arrangement, which is usual. The oxide does not then so readily become dry and hard, because the moisture which is deposited in the purifier keeps it damp.

The manner in which the bye-products may be recovered in the most valuable form has now been described. It may, however, be useful to say something on the working up of the crude bye-products.

Tar has not hitherto been worked up at even the largest of the German gas-works, because the quantity produced at any one of them would scarcely be sufficient to supply a tar-distillery working on economical lines. The initial cost of erecting a tar-works is comparatively high; and the production of chemically pure tar products, which are the only tar products which can now be made remuneratively, is difficult. Until the conditions alter, it would be unprofitable for a gas-works in Germany to distil its own make of tar. The conditions are similar in regard to spent oxide. Economical working requires a quantity of spent oxide greater than all the Berlin gas-works produce. The production of pure marketable cyanogen compounds from the spent oxide is a comparatively complex process, which is kept secret by the present prussiate works.

If, however, cyanogen is recovered from the gas by the new wet process described above, working up the crude products by the gas undertaking becomes practicable, as they are in a concentrated state. But, nevertheless, it does not follow that it would be advantageous for a gas-works to make its own cyanogen products, as the prussiate market presents many complications and difficulties. These products are subject to very great fluctuations in market value; so that an experienced salesman is needed in order to dispose of them at the right time and to good advantage. Generally, therefore, it would be best to sell the cyanogen mud or liquor, as it is made, to existing prussiate works. If, however, local conditions are favourable to working up the crude cyanogen mud on the spot, the process must be carried out off the gas-works itself. The chemical works should be as distinct as possible, both in respect of staff and working, from the gas-works. Otherwise the small chemical manufactures take away valuable working ability from the gas-works, and occupy more of the time of the gas manager than does all the remaining work, especially if he is not familiar with them, and the real business of the gas-works—manufacture, purification, and sale of gas—suffers greatly from lack of attention.

The ammoniacal liquor stands on a different footing from the other bye-products. It seldom contains more than 2 per cent. of ammonia (or is of more than about 10-oz. strength), and, therefore, the sale of the liquor would in most cases be out of the question, as freight would have to be paid on the 98 per cent. of ballast with which the ammonia is associated. Unless therefore the gas-works are situated close to the purchaser's premises, the liquor must be worked up on the gas-works itself. The most diverse products can be manufactured from the liquor; and local demand may make it profitable to produce any one of these. There are, however, only two products for which there is an assured demand in large quantities, and these are sulphate of ammonia and concentrated ammonia solution. Neither of these products demands for its production from liquor complex chemical plant. The plant and the manipulation of it have been so thoroughly elaborated, that the manufacture of either of these products may be undertaken without chemical knowledge, and with unskilled labour. Evidently, however, in a large works the supervision of the manufacture may profitably be put into the hands of a man who has had a chemist's training. Other ammonia products which may be manufactured are liquid ammonia, sal-ammoniac, and carbonate of ammonia. The production of liquid ammonia is a rather complex process; and the quality of the product must be more carefully attended to than is necessary in the case of sulphate. The manufacture will, as a rule, only be remunerative in industrial districts where there is a large demand for liquid ammonia; and in such exceptional cases, it will be found more profitable than the manufacture of sulphate. The conditions are very similar in respect of sal-ammoniac and carbonate of ammonia; and their manufacture should only be undertaken at a gas-works under quite exceptional conditions.

A comparison of the two large London Gas Companies is instructive with reference to the question of the working up of bye-products by gas undertakings. The Gaslight and Coke Company have for some time past worked up the whole of their

* See "JOURNAL," LXXIII., p. 1554. † *Ibid*, p. 1557.

bye-products, including tar, cyanogen, ammoniacal liquor, and spent oxide, at a gigantic chemical works at Beckton; while the South Metropolitan Gas Company have only worked up ammoniacal liquor, and have sold their other bye-products in the crude state. It can only be said that the Gaslight and Coke Company have not shown that the working up of their bye-products has given them an advantage economically over the rival Company.

In every case, however, whether the gas undertakings work up their bye-products or sell them in the crude state, every endeavour should be made to obtain the bye-products from the gas in a concentrated form, which is as suitable as possible for subsequent working up to other purer products. The chief aim of this paper has been to draw attention to the advantages which an observance of this principle presents.

THE NEW TABLE PHOTOMETER IN THE PROVINCES.

It was recently mentioned in the "JOURNAL" that the Gas Committee of the Birmingham Corporation had, after careful consideration and consultation with their Engineers and the Gas Referees, decided to adopt the new table photometer method of testing the illuminating power of gas with the 10-candle pentane lamp as a standard in place of candles. In order to carry out their requirements in the best possible way, a carefully drawn specification was prepared, dealing not only with the photometrical apparatus, but also with the (especially with this form of photometer) serious questions of heating and ventilating the testing-rooms. Every experimentalist is aware of, and most gas managers have suffered from, the deteriorating effect on illuminating power results of an atmosphere in a photometer-room which, in the slightest degree, diminishes the impetus of the ascending current from the standard argand burner; but only those who have given this point their special attention are fully cognizant of the difficulties that exist in ensuring uniform conditions for the oxygenation of the flame of the argand burner under varying barometric and thermometric conditions.

In addition to requiring tenders for the heating and ventilation, the Birmingham Gas Committee specified certain modifications in the table photometer which will enable them to test therewith gas of qualities varying from 16 to 20 candles. This has been effected by the designing of a special burner pillar, arranged to carry the argand burner at distances varying by the requisite amount from the position laid down by the Gas Referees' "Notification." In other respects, the photometers are in every way similar to those prescribed for the London testing-stations.

A new vapour tension thermostat is being introduced for controlling the gas supplies to the heating arrangement, which consist (at Windsor Street and Sheep Street) of gas-heated boilers feeding low-pressure pipes disposed round the rooms; while in the other stations, provision is made for the feeding of gas-fires with air drawn from the ceiling-level—the gas supplies being controlled by thermostats. The air supplies to the rooms are capable of absolute control; specially-designed exit-valves being used to ensure their proper direction.

Messrs. Hunt and Hack, the Corporation Gas Engineers, have evidently determined that their testing-rooms shall be second to none in the kingdom; and the Birmingham Gas Department are to be congratulated upon their courage in taking the initiative in this important matter. The tender of Messrs. Alexander Wright and Co., Limited, for the photometers has been accepted by the Committee; and the schemes of the same firm for heating and ventilating the stations having also been approved, they have likewise secured the contract for this part of the work.

THE ACETYLENE SUPPLY STATION OF SCHONSEE, WEST PRUSSIA.

The fact that a works had been established at the small town of Schönsee, in West Prussia, for the public supply of acetylene has already been alluded to in the "JOURNAL." Full particulars of the installation, however, are now in our hands in the form of a reprint of a communication on the subject by Dr. Paul Wolff to a recent number of "Glaser's Annalen für Gewerbe und Bauwesen;" and we give below an abstract from that paper of some of the more interesting details.

Dr. Wolff first describes general facts relating to the production and use of acetylene. He refers to the alluring simplicity of the generation of acetylene from carbide, and the difficulties and dangers which make themselves evident as soon as the generation is attempted on any but the smallest experimental scale. He classifies generators into three groups, of which the first two—viz., the drip and the dip appliances—he considers unsuitable for central supply stations, and not altogether free from danger. He gives the experimental evidence in respect of heat development and after-make in these classes of generators in much the same manner as he gave it in an earlier communication, which was reproduced at length in the "JOURNAL" (Vol. LXXII., pp. 1032, 1102, and 1164). The third class of generators—viz., those in which the carbide is plunged into a large excess of water—is considered by him to comprise the only generators which can be trusted to work safely and reliably. Even with these generators, attention must be given to certain points in order to ensure safe working. Most important is it that the acetylene produced should be free from air, even when the generator is first set in action. How this consummation is attained in the apparatus which is favoured by Dr. Wolff, has been shown in the description of the Pictet-Wolff generator on p. 1164 of Vol. LXXII. of the "JOURNAL." The limits between which mixtures of air and acetylene in various proportions are explosive are very wide, as is well known; hence the necessity for avoiding the possibility of any such mixtures being produced in the generating plant. At Schönsee, generators of the Pictet-Wolff type are followed by a condenser, a washer in which ammonia and sulphuretted hydrogen are absorbed, a purifier in which phosphuretted hydrogen and any remaining sulphuretted hydrogen are taken up, and a drying apparatus. The washer and purifier are charged respectively with a saline solution and material containing a hypochlorite, as has been described in Dr. Wolff's earlier paper already referred to. The gas passes from the drying apparatus into a gasholder, and thence through a station meter and governor to the distributing mains.

The Schönsee installation was carried out by the "Allgemeine Carbid- und Acetylen-Gesellschaft," of Berlin. It was designed to supply 2000 burners, of which 23 were for public lamps. The average consumption of a burner is about 0·35 cubic foot per hour; therefore plant to supply 2000 burners must be capable of producing about 700 cubic feet of acetylene per hour. But, having regard to possible extensions of demand, the Schönsee plant was made of such a size as to yield 1050 cubic feet per hour in normal work, and 1400 cubic feet or more when pushed. It comprises three generators, each capable of producing under ordinary conditions 350 cubic feet per hour. Normally two of the generators should be in use, and one in reserve. They are fed from a stage, which is approached from the interior of the building by a staircase, and is supplied through a door in the wall of the building with the drums of carbide as required. The chimneys from the generators pass through the roof of the building, and thus carry at once into the open any traces of acetylene which escape. The residual lime is run off through a channel leading to a tank outside the building. Two purifiers are provided, and have suitable connections and valves to allow of either being used while the other is shut off for recharging or repairs. The gasholder has a capacity of 700 cubic feet, and stands in the open. The station meter and governor are in an annexe of the main building. A wet meter is used. Pressure gauges connected with all the principal parts of the plant are arranged on one board, so that the attendant may see at a glance if the whole of the apparatus is working properly. The building and the gasholder are provided with steam-heating apparatus, so as to prevent freezing in cold weather. The main building is about 20 feet long, 16½ feet wide, and 15 feet high. Wrought-iron pipes, 4 inches in diameter, connect the several parts of the plant. A pump driven by a vertical motor of 1-horse power, which consumes about 7 feet of acetylene per hour, is used to supply water to the generators, &c.

The distributing system constitutes the most costly item in such an installation for the supply of acetylene; but nevertheless it is considerably less expensive than mains and services to supply coal gas to the same number of burners would be. Owing to the greater cost of a given volume of acetylene, it is, however, far more important that all mains and services should be sound. Galvanized and tarred wrought-iron pipes are used at Schönsee, and are laid at a depth of 40 inches from the surface. The main from the works is 4 inches in diameter, and the mains in the outlying streets are of intermediate sizes down to 1¼ inches in diameter. Syphons are provided at various points; but during several months' working, no more than a few drops of water has been removed from any syphon. The street lamps are about 155 feet apart; and are provided with the bifurcated burner illustrated in fig. 2, on p. 1165 of Vol. LXXII. of the "JOURNAL." These burners are used in two sizes, consuming 0·35 and 0·53 cubic foot per hour; and giving respectively lights of 14 and 22 candle power. Sixteen of the street lamps are fitted with the smaller, and seven with the larger sized burner. The cost of the street lighting, with acetylene at £2 9s. 6d. per 1000 cubic feet, and a lighting time of 700 hours in the year, amounts to 12s. 3d. for small, and 18s. 4d. for large burners per annum. Two of the large burners are, however, kept alight throughout the night. The total cost of the street lighting amounts to about £23 per annum, which is only about £1 more than the street lighting by means of only nine benzoline lamps formerly cost the town.

Electric Lighting Orders and Licences.—A return just issued by the Board of Trade shows that during the years 1883-98 inclusive the number of Orders applied for under the Electric Lighting Acts was 644, and the number made by the Department was 457, of which 452 were confirmed by Parliament. The number of these Orders that have been revoked or repealed is 103. The figures for 1898 are: Applications, 84; Orders made, 67; Orders confirmed by Parliament, 65—totals which have been exceeded only in 1883 and 1890. With regard to Licences, the total number applied for during the sixteen years was 46, of which 30 were granted and 28 have been revoked or repealed or have expired. No Licences were applied for during last year.

REGISTER OF PATENTS.

APPLICATIONS FOR LETTERS PATENT.

14,675.—Farrington, R., and Hawes, M. H., "Gas-burners." July 17.
14,694.—Boudart, L., "Carburetters." July 17.
14,698.—Gerdes, A., "Gas-lamps." July 17.
14,714.—Smith, J. S., "Generation of acetylene gas." July 18.
14,726.—Moorwood, T. P., Moorwood, H. S., and Bennett, J. F., "Gas-generators for motors and other purposes." July 18.
14,735.—Brown, A. C., "Electric igniters for oil, vapour, and gas engines and the like." July 18.
14,753.—Beechey, C. G., and Wright, A. T., "Coin-freed or actuated gas or similar meters." July 18.
14,791.—Lelandais, V., and Nauhardt, P., "Gas, petroleum, and analogous motive-power engines." July 18.
14,821.—Hughes, A. T., "Gas-burners for use in inspecting the interiors of casks and the like." July 18.
14,824.—Pordes, B., "Automatic gas-lighters." July 18.
14,836.—Davis, L. K., "Filter-beds." July 18.
14,853.—Henley, W., "Railway signal and other illuminating lamps." July 19.
14,873.—Warry, J., Arculus, G. N., and Arculus, E. A., "Holding or supporting chimneys of incandescent gas-burners." July 19.
14,900.—Wood, C. V., "Gas-burners." July 19.
14,938.—Donovan, E. W., and Marsh, T. G., "Coin-freed automatic machines." July 20.
14,948.—Shaw, E. J., "Gas lamps and lanterns." July 20.
14,984.—Bridges, C. M., "Acetylene gas-generator." July 20.
14,995.—Duncan, J. H. H., The New Sunlight Incandescent Company, Limited, and Barnett, H. T., "Incandescence gas-burners." July 20.
15,020.—Aykroyd, J. & B., "Acetylene generators and holders." July 21.
15,024.—Fawcett, J., "Gas-engines." July 21.
15,076.—Liebes, L., "Gas-burners." July 21.
15,077.—Martini, A., "Ignition apparatus for gas-burners." July 21.
15,114.—Walton, J., "Gas and oil engines." July 22.
15,119.—Grautoff, A. H., and Fritz, F., "Burners for gas lighting by incandescence." July 22.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Is Birmingham Gas Dear?

Sir,—In an "Editorial Note" on the above subject in your last issue you make the following remark: "Birmingham might have cheaper gas to-morrow if it would spare the undertaking the subsidies which it pays over to the district rates." Will you permit me to point out, with reference to this, that the amount contributed per 1000 cubic feet of gas sold by Birmingham is less than that at Widnes; the figures for last year being 1·6d. and 1·98d. respectively.

You further state that you do not propose to go into the question of Widnes gas and how it is that it can be sold at so cheap a price This statement I regard as somewhat unfortunate, as it cannot be other than a matter of general interest to know what the best results are, and where and how they are obtained. In the same number of the "Journal" your Scotch Correspondent in his "Notes" reproduces a letter of mine to a Glasgow paper, in which I give the details of cost of manufacture, &c, at Widnes; and he concludes by briefly stating that better results are obtained at Hamilton. Of course, no one, without knowledge, can either question or support your correspondent; and I do submit that it would have been much more satisfactory had this statement been accompanied by the comparative figures alluded to in my letter.

Your correspondent also states that the meter-rents in Widnes vary from 1s. 4d. for a two-light meter to £4 for a 400-light meter. As far as my experience goes, meter-rents are spoken of and understood as they are collected—*i.e.*, quarterly; and I venture to think that nine out of every ten reading the above figures would take them as the quarterly charges, whereas they, in reality, are the yearly ones. Your correspondent is not, I feel, likely to err on the side of Widnes; but surely it is not too much to ask that he should be explicit in his remarks. The meter-rents amount to 0·48d. per 1000 cubic feet sold. I may add that there is no occasion for surmise in any one particular with regard to the working at Widnes; and if there are other points requiring elucidation, to enable a comparison to be made between these or any other works, I am at the call of either you or your Scotch Correspondent.

Isaac Carr.

Widnes, July 27, 1899.

Experience with the Hydraulic Main.

Sir,—There has been a good deal said of late respecting the hydraulic main; and as it has been an acquaintance of mine for about fifty years, I should like to say a few words about it. I was much interested in the paper read by Mr. William Carr, of Stalybridge, on the subject at the meeting of the Gas Institute, and quite agree with all he said. As to the chemical action of the main as a physical contrivance, he stated that the old form of main was the best; and by the "old form," he meant all forms of main where a tar seal is in use. Great credit is due to Mr. Carr for the way in which he explained the use of this mysterious appliance. For large works, this hydraulic main should not be less than 20 inches square. It is advisable not to use anti-dips or a water-seal; and the gas should not be separated from the tar in the main. They should be left to travel together until they reach the condenser. The hydraulic main acts as a water-seal, condenser, and purifier. I have already explained this in an article on "The Work of the Hydraulic Main" which appeared in the "Journal" for Dec. 7, 1897; and I may mention that I am about to offer to gas managers a new style of main which will be self-cleaning, and will, I fully believe, reduce stoppages in ascension-pipes to the extent of 70 to 80 per cent.

S. Carpenter.

East Ham, Essex, July 28, 1899.

PARLIAMENTARY INTELLIGENCE.

THE INQUIRY INTO THE POWERS OF CHARGE OF THE METROPOLITAN GAS COMPANIES.

The Committee's Report.

In the "Journal" last week, we were able to indicate some of the recommendations of the Select Committee appointed by the House of Commons to "inquire into the powers of charge conferred by Parliament on the Metropolitan Gas Companies," as contained in their report presented to the House the previous day. The report has since been published, and we give it practically in its entirety. The Committee examined witnesses from the Board of Trade, the London County Council, the Corporation of London, and several of the Metropolitan Vestries, as well as representatives of the three Gas Companies concerned. The history of the position of the Metropolitan Gas Companies, and the legislation connected with them, was very fully stated by Sir Courtenay Boyle and Mr. Haward, on behalf of the Board of Trade and the London County Council respectively; and a full and interesting memorandum was drawn up for the Committee by Lord Farrer, formerly Permanent Secretary to the Board, on the position of the Companies in the year 1876. Under these circumstances, the Committee commence their report by stating very shortly the history of Metropolitan Gas Legislation since 1875, as follows:—

In 1875 the gas supply of the Metropolis was in the hands of nine Companies, which were under various conditions, and whose charges also were different. This state of affairs gave rise to great discontent among the consumers; and three Bills were introduced into Parliament in 1875 by the Metropolitan Board of Works, one of which was for the establishment of competing gas-works, another for the purchase of existing Gas Companies, and a third for imposing more stringent regulations upon the Gas Companies. None of these Bills were, however, passed. A suggestion contained in one of them, afterwards amended by Mr. Forster's Committee, and approved of by the Board of Trade in the year 1875, led to the principle of what is called the sliding scale being applied to price and dividend. The Commercial Company's Act of that year and the South Metropolitan Act of 1876, and all subsequent Gas Acts for the Metropolis embodied this arrangement; and under sections 18 to 24 of the City of London Gas Act, 1868, and section 64 of the South Metropolitan Gas Act, 1876, amalgamations took place between the Metropolitan Gas Companies, which reduced the number to three—namely, the Gaslight and Coke Company, the Commercial Company, and the South Metropolitan Company.

These three remaining Gas Companies are practically under the same laws and regulations, with the exception that the Gaslight and Coke Company and South Metropolitan Gas Company are obliged by their Acts of 1876 to raise all their new capital by public auction or tender, whereas the Commercial Company is not under that obligation, its Act having been obtained in 1875. Also the standard price laid down for the South Metropolitan Gas Company is 3s. 6d. per 1000 cubic feet of gas, whereas the standard price for the Gaslight and Coke Company and the Commercial Company is 3s. 9d. per 1000 cubic feet. The standard dividend is, in all cases, 10 per cent.

The arrangement of the sliding scale, as it is called, enables the Companies to increase their dividend above the standard rate by ¼ per cent. upon the ordinary stock of the Company for every 1d. of decrease in the price of gas below the standard price, and obliges the Companies to decrease their dividend by ¼ per cent. below the standard dividend for every increase of 1d. or part of 1d. in the price of gas above the standard price. This arrangement has, on the whole, had an excellent effect upon the Companies, and has given them a strong motive to keep down the price of gas, and has also operated to the advantage of the consumers; while, on the other hand, the Companies have reaped an enormous advantage by being able to divide large sums over and above the 10 per cent. dividend to which they were formerly limited. Since the introduction of the sliding scale, the prices charged for gas have at no period been as high as the standard price permitted to each Company, and in every case have fallen considerably below the prices charged before the introduction of the sliding scale. In saying this, we do not wish it to be inferred that the whole of the reductions which have taken place in the price of gas since 1876 are to be attributed to the operation of the sliding scale, because, as will appear from remarks made later on in our report, other causes have operated to decrease the cost of manufacturing gas.

The auction clauses which compel the Companies to sell their stock and their loans to the highest bidders have had the effect of enabling the Companies to obtain their capital at a much less rate than if the stock had been offered to each shareholder at par, which was the usual custom before 1876; and thus the charge for interest on capital has been largely reduced. Expert evidence upon this matter seems to be entirely in its favour.

Your Committee have no hesitation in coming to the conclusion that the principle of the sliding scale coupled with the auction clauses is an excellent one, and should be maintained. They will, however, have some remarks to make, and suggestions to offer, later on upon the figures of the present scale.

Since 1883, which is the date of the last amalgamation which was effected by any of the three existing Companies, when the London Company was absorbed by the Gaslight and Coke Company, there has been invariably a considerably higher charge made for gas by the Gaslight and Coke Company, to its consumers north of the River Thames, than has been made by either of the other two Companies; and this difference has been growing in recent years. By an Order in Council made in 1883, permitting the amalgamation of the London Company with the Gaslight and Coke Company, it was provided that the price of gas charged in the new area obtained by the Gaslight and Coke Company south of the Thames must never be greater than the price charged by the South Metropolitan Company to private consumers, and that the

price for all street lighting throughout the whole of the Gaslight and Coke Company's district should be at the lowest price charged to any consumers. Thus it is the case that within the limits of the Gaslight and Coke Company there is one price for private consumers north of the Thames, and another price for private consumers south of the Thames; and as the price charged north of the river is much higher than that charged south of the river, great discontent has been frequently manifested by the inhabitants in the northern part of the Gaslight Company's district, and the great difference in the price charged has been the principal reason for this inquiry. The price charged by the Gaslight and Coke Company north of the Thames to its private consumers has never been below 2s. 9d. per 1000 cubic feet in any year except in 1889 and the first half-year of 1890, when it was 2s. 6d. Since then it has varied from 2s. 9d. up to 3s. 1d., and is now 3s. The Commercial Company has since 1876 varied in its charge per 1000 cubic feet from 3s. 9d. to 2s. 4d.; but since 1883 has never been above 2s. 9d., and for the last five years has been 2s. 6d. The South Metropolitan Company has never since 1876 been above 3s. 2d., and since 1886 has been under 2s. 7d., and is now 2s. 2d. It is also a fact that, as compared with most of the small Suburban Companies round London, some of which supply gas within the Metropolis, the price charged by the Gaslight Company is very high. The same observation may be made if the comparison be extended to most of the large provincial towns. It may be true that the local conditions vary; and your Committee are not disposed to press the comparison too far.

It is evident, therefore, that the Gaslight Company has for a long period charged a much higher price for gas than have the other two Companies; and upon this fact the first-mentioned Company has been arraigned by those interested in the matter on a charge of want of proper skill and ability in the management of the affairs of the Company. Your Committee will now proceed to state the charges made against the Gaslight Company, and consider the answers made by that Company to these charges.

The ostensible and admitted fact is that to private consumers north of the river the Gaslight and Coke Company is at present charging 10d. (or, taking into account the fact that the Gaslight Company make no charge for meter-rent, 9¼d., or thereabouts) per 1000 cubic feet more than the South Metropolitan Company, and 6d. more than the Commercial Company; and from this fact it is argued that incompetence and want of business capacity has been shown by those responsible for the affairs of the Gaslight and Coke Company. It is alleged that a wasteful and unwise expenditure of capital has been made by this Company, partly in times gone by, by placing their works inland, and so involving the necessity of building new works in more convenient positions, as at Beckton, and also by a want of forethought and knowledge in the erection of plant of an obsolete character. Many comparative statements of the amount of capital spent by the three Companies have been presented to the Committee; but it may be briefly stated that it is allowed by all witnesses that the capital spent by the Gaslight and Coke Company is in every comparison greater in proportion to its business than that of either of the two other Companies. According to Mr. Field's evidence, who speaks on behalf of the accused Company, the capital employed per 1000 cubic feet of gas sold, for the Gaslight Company, is 12s. 6d.; for the Commercial Company 8s. 8d.; and for the South Metropolitan 8s. 10d. in the year 1898. Thus it will be seen that the Gaslight Company exceeds the Commercial Company by 3s. 10d., and the South Metropolitan Company by 3s. 8d. per 1000 cubic feet sold.

While touching upon the question of capital, it should be stated that evidence has been given to the effect that the amalgamations carried out by the Gaslight and Coke Company have been beneficial to that Company; and that at the time of the various amalgamations, the capital of the Gaslight Company was always greater in relation to 1000 cubic feet of gas sold than was the capital of the absorbed Company, and it is asserted that without these amalgamations the capital of the Gaslight Company would stand at a much higher figure than it actually does. It is also stated, and not denied, that the new areas brought in by the various absorbed Companies added largely to the productive area enjoyed by the Gaslight Company.

Further accusations have been made against the Gaslight Company that it has not shown wisdom in the kind of plant which it erected at Beckton, but that it put up the old-fashioned single holders instead of telescopic holders, which, at a small increased cost, have three times the capacity; and that in other ways labour-saving plant and machinery have not been adopted as they ought to have been. It is further alleged that a want of foresight has been prominent in the methods employed by the Gaslight Company in the purchase of coal, in the sale of their residuals, in their lighterage arrangements, in their action with respect to the rates charged upon the Company, and also in their dealings with their reserve fund, and in the expenditure upon the automatic meters supplied by them.

In reply to these accusations, the Gaslight and Coke Company say that with regard to the question of over-capitalization, the chief cause why they have been obliged to expend a larger proportionate capital than the other two Companies, has been the obligation enforced upon them by Parliament to close their works at Westminster, Goswell Road, Brick Lane, and Blackfriars, and to build large new works at Beckton. The Gaslight and Coke Company admit the desirability of this removal, as far as the convenience of working is concerned, but allege that it has necessitated a large and new expenditure of capital. Also, it is stated that after the amalgamation in 1876 with the Imperial Company the works of that Company at Bromley, which were taken over by the Gaslight Company were to a large extent unused, as it was found more profitable to make the gas at Beckton than at Bromley; and thus a large amount of capital laid out by the Imperial Company and bought by the Gaslight Company was disused. Mr. Field, on behalf of the Gaslight Company, stated that, taken together, the disused or obsolete capital at the four closed works alluded to above, and at the Bromley works, amounted to £805,000.

In addition, however, to this, Mr. Field alleges that a large expense had to be incurred in bringing the gas from Beckton up to the district supplied by the Company; that railway facilities had to be acquired, and works for the residual products established at Beckton; and that the cost of all these operations, including the sum mentioned above, came to about £1,500,000.

In answer to the charge of want of forethought shown in the character of the works and plant put up at Beckton, Mr. Field alleges that, owing to the exposed nature of the situation at Beckton, it was thought at the time (1870) that it would not be safe to erect telescopic or three-lift holders; and that not doing so was not a want of knowledge but a matter of prudence. Mr. Field admits, however, that he considers that subsequent experience has not justified this idea; and if it had to be done over again three-lift holders would be used.

It is not, however, contended that this outlay of £1,500,000 is altogether unprofitable; and in view of the admitted advantages which Beckton offers for the manufacture of gas, the undertaking as a whole cannot have suffered to the extent alleged by Mr. Field through the removal.

Another answer which the Gaslight Company make to the charge of over-capitalization is that, owing to the nature of their supply being to large shops and an immense mileage of streets, and also to the signals of the Underground Railway, it is necessary for them to have always a very large supply of gas in store, in case of a fog which may come on at any moment, and the extra storage and plant required has obliged them to incur capital outlay to the extent of £400,000. The necessity for so doing was, however, disputed by Mr. Livesey.

Again, another plea raised by The Gaslight and Coke Company to account for the fact that their capital is high in proportion to the gas sold by them is that in their district the electric light has been largely adopted, and has displaced gas to an extent of something like 3000 millions of cubic feet—thus causing the capital spent in providing for such supply of gas to be unprofitable. It has, however, been suggested that the competition of the electric light would have been less effective if the charges of the Company had not been so high.

Another cause alleged as requiring an extra outlay of capital in the Gaslight and Coke Company's district, as compared with the South Metropolitan and Commercial Companies' districts, is that the roadways and pavements required to be broken up and repaired for the purpose of inserting the mains and service-pipes are of a much more expensive character in the Gaslight Company's district than in the other two Companies. No estimate of the total amount of extra capital required for this purpose was given.

Passing on now to the next matter—namely, the incapacity alleged to be shown by the Gaslight Company in their purchase of coals—the Committee has had evidence given by Mr. Livesey, that by unwise holding out for a lower price, the Gaslight Company has, on certain occasions, outstood the market, and in the end been obliged to buy their coals at a higher price than they might have done had they bought at a more opportune moment; and an instance was given where a loss of £100,000 was incurred by the Gaslight Company. But in reply to this, the Gaslight Company say that they admit on some occasions to have been in error as to the precise moment when they ought to have bought their coal; but taken on the whole, and over a long period, their operations in coal have been as economical as those of their neighbours, and they claim that the clause which they have inserted in their coal contracts, and which is known as "a favoured nation clause" is a wise and business-like provision, which gives to them any advantage which may be subsequently obtained by any other Gas Company in any dealings with the same coal contractor.

The Gaslight Company further allege that, owing to the fact of their having more lighterage to pay than the South Metropolitan Company, a good reason exists why the price for coal should always be somewhat higher than that paid by the South Metropolitan Company. According to Mr. Haward, in 1897, the cost of coal for the three Metropolitan Gas Companies was for—

	Per Ton.	Per 1000 Feet Sold.
Gaslight	11s. 1·82d.	.. 13·69d.
South Metropolitan	10 4·22	.. 13·00
Commercial	11 9·15	.. 14·87

It appears, therefore, that the price paid per ton for coals by the Gaslight Company is 9·60d. more than the South Metropolitan, and 7·33d. less than that paid by the Commercial; and for every 1000 cubic feet of gas sold the difference is 0·69d. in favour of the South Metropolitan over the Gaslight Company, and 1·18d. in favour of the Gaslight Company as against the Commercial Company.

Passing on to the question of the sale of the residuals from the coals—namely, coke, breeze, tar and its products, ammoniacal liquor, sulphate, &c.—the reply of the Gaslight Company to the charge of incapacity in their dealings in these commodities is that at Beckton, where the most part of their coke has to be disposed of, there is no local market for coke; and hence they are at a disadvantage in their sales as compared with the two other Metropolitan Gas Companies. They point out that, taking the total price obtained for all residuals from a ton of coal, in the year 1898, the Commercial Company was better by 1·94d. than the South Metropolitan, and the South Metropolitan only 0·34d. better than The Gaslight and Coke Company; and they argue that these differences do not imply want of good management, but differences in local circumstances and local facilities for the disposal of their residual products.

Another charge brought against the Gaslight Company by Mr. Livesey is that they have not managed the lighterage of their coal up to their wharves as economically as they ought to have done, and have not adopted the plan of the South Metropolitan Company of owning their barges. The Gaslight Company, in reply, contend that the distance which they have to convey their coal from the ships to the wharves is on the average much greater than that of the South Metropolitan; and Mr. Field, speaking for the Gaslight Company, denies that there is any economy in laying out money in barges. The cost of lighterage of the Gaslight Company is stated to be 6¾d. per ton of coal.

The question of the rates charged by the local authorities upon gas undertakings is a somewhat complicated one, and largely depends upon the amount of capital belonging to a Company; and therefore the rates of the Gaslight Company are necessarily higher than those of the South Metropolitan Company, as the capital of the former is greater in proportion to the amount of gas sold than in the latter. But the charge made against the Gaslight Company is that, if due diligence had been exercised, these rates might have been reduced; and again, that want of judgment was shown by raising the price of gas while an appeal against an assessment was pending. As a reply to this, Mr. Field states that he considers that the Gaslight Company have been more successful in their

appeals against their rating than the South Metropolitan; and that since the last valuation the rates of the Gaslight Company have gone up only 9·4 per cent., whereas the rates of the South Metropolitan Company have gone up 12·9 per cent. It is admitted, however, that the rating of the Gaslight Company adds 1d. per 1000 cubic feet to the cost of production by that Company above that of the South Metropolitan.

The capital of a Gas Company is of considerable importance in connection with this question of rating; and your Committee will refer to this matter later on in their report. They desire, however, to draw attention to the memorandum upon rating drawn up by Mr. Haward.

Turning now to the question of the reserve fund, it is alleged that the Gaslight Company have depleted their reserve fund for the purpose of keeping up their dividends; and it is the fact that since the year 1889, when the reserve fund of the Company stood at £517,198, the reserve fund has been reduced to £49,868 at the end of the year 1898. This large reduction has gone to make good deficiencies on the year's working in 1890, 1891, 1895, 1896, 1897, and enable the Company to maintain their dividends. The prudence of this action is impugned. The Gaslight Company, however, reply that, under the clause of their Act of 1876, which granted them the right of accumulating a limited reserve fund, it was expressly laid down that the fund so raised could only be applied in making up the dividend in years when a deficiency arose; and that it was better for the consumers as well as the shareholders that prices and dividends should not constantly vary from year to year, and that the reserve fund belonged to the shareholders, and must eventually be applied in payment of dividends. It must be understood that the Companies have no power to reduce capital by any payments out of the reserve fund. It is further stated by the Gaslight Company that the other Companies have used their reserve funds in a similar way. But it is to be observed that both the other Companies immediately afterwards sacrificed some portion of their dividends, and set to work to build up their reserve funds again out of dividends; whereas the Gaslight Company did not do so, but distributed all that they could legally divide.

Passing on now to the accusation brought against the Gaslight Company, that they have expended too much for their fittings and stoves supplied with automatic or slot meters, it is contended by the Gaslight Company that they supply very superior fittings, pipes, &c., and have consequently expended a larger sum upon them. The cost of their fittings, including stove, meter, service pipe, &c., is £8 13s. 8d.

A question arises upon the charge for the gas supplied by the Gaslight Company south of the river, through their slot meters, which the Committee will deal with in a subsequent paragraph.

In addition to the reasons already adduced by the Gaslight Company for their larger cost of gas, they say that, owing to the distance of their testing-stations from their works, the gas requires to have greater illuminating power, or enrichment as it is called. Again, they say that owing to their pension system for their workmen, their wages are practically higher, and, as already stated, their slot meters more costly, and their general distribution and collection more expensive; and summing up in figures as nearly as they can, they put down as extra cost over and above the South Metropolitan—

For interest on capital	3·6d. per 1000 cubic feet.
Rates	1·1 ,,
Lighterage	·5 ,,
Extra enrichment	·4 ,,
Residuals	·7 ,,
Wages	·7 ,,
Slot-meters	·3 ,,
Distribution	·1 ,,
Total	7·4d. per 1000 cubic feet.

Thus making a total difference of 7·4d. on every 1000 cubic feet sold; and they allege that having regard to the fact that they supply their area south of the river at 2s. 2d. per 1000, and all their district with street lighting at 2s. 2d. per 1000, the actual average price over the whole of their supply should be stated as 2s. 10·62d. and not 3s., and deducting the 7·40d. from 2s. 10·62d. there remains only the price of 2s. 3 22d. per 1000 cubic feet —a price very little above the South Metropolitan.

The Committee have very fully considered all the evidence submitted to them; and, after giving due weight to the reasons offered by the Gaslight and Coke Company, in explanation of the higher price charged for their gas, they are of opinion that the affairs of the Company have not been well managed. The intention of the sliding-scale was to give to the consumers a special interest in economical administration, while the control was left exclusively in the hands of the Company. Hence there was an implied obligation on the part of the Company that their affairs should be administered (to quote the language of Mr. Cardwell's Committee) "with due care and management." Your Committee have arrived at the conclusion that this has not been done. Hence, the intention of the parliamentary bargain which was in effect made, has not been realized by the Company, and thus the benefit to the consumers which was contemplated when the standard price was fixed nearly a quarter of a century ago has not been obtained. With regard to Mr. Field's explanations on the subject of over-capitalization, your Committee would point out that even accepting integrally the sums of £1,500,000 and £400,000 expended respectively on the Beckton works, and on extra storage in case of emergency, they only amount to a total of £1,900,000. On the other hand, the difference in the capital cost of 3s. 8d. per 1000 cubic feet, as shown above, between the Gaslight and Coke Company and South Metropolitan Company, amounts, on the 21,000 millions of gas sold by the Gaslight and Coke Company in 1898, to £3,850,000.

Your Committee think it probable that in years gone by there has been a wasteful expenditure of capital by the Gaslight Company; but this cannot now be remedied as far as the money spent is concerned. An important question, however, arises in respect of reducing this capital, inasmuch as a reduction of capital would permit of a reduction of rates, and thus enable the Company to produce gas, and consequently sell gas, at a less price; and your Committee are prepared to make a recommendation on this point.

Your Committee are of opinion that but little benefit would accrue to the public were they to attempt to dictate to Managers of a Gas Company how to carry on their business; and, therefore, your Committee will only apply themselves to those questions which seem to them to be within the scope of parliamentary action, and to suggest some means of enabling the Gaslight Company to lower its price. The Committee feel that they must leave the disputed and intricate questions of purchase of coals, disposal of residuals, enrichment of gas, and many others, to be settled by those responsible for carrying on the business.

The Committee have had the question of the area south of the river Thames, supplied by the Gaslight Company under their agreement with the London Company in 1883, brought very prominently before them; and strong evidence has been adduced to show that the price charged in the northern area by the Gaslight Company was increased by 1d. per 1000 cubic feet on account of the low price which the Company was by law compelled to charge in the southern area. This evidence was challenged by Mr. Field on behalf of the Gaslight Company; but the Committee did not think that it was in any way disproved. It was admitted by Mr. Field that the cost of producing gas in the southern area at the Nine Elms works was 2s. 4½d. per 1000, and that the selling price was now 2s. 2d.; and hence it seems obvious that there is a loss of 2½d. upon every 1000 cubic feet sold. As about 953 million cubic feet are sold in the southern area, the annual loss amounts to £10,000 in round figures. No doubt, gas is produced more cheaply at Nine Elms than at some of the Gaslight Company's works; but evidence was put before the Committee that gas could be most cheaply produced at Beckton. It appears, therefore, to your Committee that it would be advantageous to all concerned in this matter if the southern area of the Gaslight Company were transferred to the South Metropolitan Company, who apparently are able to produce gas at the price of 2s. 2d. at the present time, and by so doing the Gaslight and Coke Company would avoid a considerable loss, and would, in consequence, be able *pro tanto* to reduce the price of gas to their consumers in the area north of the Thames. The question of the retention of the Nine Elms works by the Gaslight Company is one which would require careful consideration and adjustment between the two Companies. Whatever might be the amount decided on as a fair price to be paid to the Gaslight Company for their property in the southern area, it would go either in reduction of present capital or in lessening the amount of any new capital required, and would have the effect of lessening the assessment for rates, and so further cheapen the production of gas.

As indicated in a former paragraph, your Committee have come to the conclusion that the arrangements known as the sliding scale as applied to dividend and price, in conjunction with auction sales of stock, have had a beneficial effect upon gas undertakings, especially as far as the consumer is concerned; and they have received no evidence to induce them to propose any alteration in the system. But evidence has been tendered which leads them to think that now the standard price is fixed too high, and as a consequence dividends may be paid far above the standard dividend without the full effect of the intention of the framers of this system with regard to the exercise of "due care and economy" being brought into play. Your Committee therefore have come to the conclusion that the time has come when a reduction in the standard price might fairly be recommended on the grounds that the cost of the production of gas is now much less than it was when the present standards were fixed, and also because capital can now be obtained at a much less rate of interest than formerly. The Committee believe that a small reduction of the standard price, coupled with a secondary sliding scale for increasing or decreasing dividends, would act beneficially towards securing "due care and economy" in management, and that a system can be so devised that, while it would stimulate those Companies which had not succeeded in bringing their prices to a low level to greater endeavours to that end, it would not interfere with those Companies which had already attained low prices. Such a scale has been suggested to the Committee by one of its members, and having met with the approval of the Committee, is embodied in their recommendations. It appears, however, to the Committee that this new scale should only be put into operation when any of the Metropolitan Companies applies to Parliament for power to raise further capital.

As the conditions of the gas industry are liable to great fluctuations, the Committee have given some consideration to the question as to how far it is right and proper to allow the Companies to acquire capital powers for any lengthened period; and the Committee have come to the conclusion that, for the benefit both of the Companies themselves and of the consumers, it would be a wise provision to limit the period for which capital powers were granted to five years, and at such periods if any Company came to Parliament for new capital powers it would, of course, be within the power of Parliament to revise the sliding scale if it was thought just and necessary to do so.

The Committee desire to draw attention to the differential charge made by the Gaslight Company for automatic meters in the northern area as compared with the southern area. It appears, from evidence given by Mr. Field that, although compelled by law to charge the same price for gas to their slot-meter consumers in the two areas as is charged to other private consumers—namely, at the present time, 3s. in the north and 2s. 2d. in the south—the Gaslight Company makes a different charge to slot-meter consumers in these two areas for the use of their fittings. That is to say, they charge the slot or automatic gas meter consumer in the north 3s. 9½d. per 1000 cubic feet, and in the south 3s. 4½d.; and as gas must be sold at 3s. in the north and at 2s 2d. in the south, it is obvious that the charge for fittings is 9½d. in the north and 1s. 2½d. in the south. As the fittings appear to be the same in both areas, your Committee consider that the higher price charged for them in the south is altogether unjustifiable; and they are of opinion that a clear statement of the rates charged for gas, meters, &c., should be furnished to each consumer.

Having carefully considered the various points alluded to in the foregoing paragraphs, your Committee now venture to make the following

Recommendations.

(1) That whenever any of the Metropolitan Gas Companies again come to Parliament for an extension or alteration of their capital powers, a revision of the sliding scale should take place, and that the standard price should be reduced to 3s. 3d. to carry the standard dividend of 10 per cent., and that the existing scale of increase and decrease of dividend of ¼ per cent. for every 1d. of decrease or increase of price below or above 3s. 3d. be maintained, and that a secondary or additional scale be imposed which should permit of an increase or decrease of

dividend over and above that regulated by the present scale of ¼ per cent. for every complete 3d. of decrease or increase below or above the standard price of 3s. 3d.

(2) That the area south of the River Thames at present part of the district of the Gaslight and Coke Company, acquired by them from the absorption of the London Gas Company in 1883, should be transferred from the Gaslight and Coke Company to the South Metropolitan Gas Company; a fair and reasonable price being paid by the latter to the former Company for their property in the southern area.

(3) That the charge made by the Gaslight and Coke Company for the rents of automatic meters and stoves should be the same to consumers north and south of the Thames for fittings of the same quality and capacity; and that the prices charged by all the Companies for these slot meters and fittings require regulation, having regard to the fact that the business is a new one, and has extended with extraordinary rapidity throughout the Metropolis.

(4) That capital powers should not be granted to any Gas Company for more than five years, if and when new capital is required; and that Parliament should revise the sliding scale, either by way of increase or decrease, when any application for new capital is made, if the circumstances of the times or the conditions of the Company appear to require it.

(5) That an effort should be made by any Company having obsolete or unproductive capital to redeem such capital by sinking fund or otherwise.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported: Derwent Valley Water Bill, Dublin Corporation Bill.

Bills read the third time and passed: Bootle Corporation Bill, Darwen Corporation Bill, Dublin Corporation Bill, Godalming Corporation Water Bill, Menstone Water Bill, Warrington Corporation Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills reported: Gas Orders Confirmation (No. 2) Bill; Wolverhampton Corporation Bill.

Lords Bills read the third time and passed: Lea Bridge District Gas Bill, Leigh-on-Sea Urban District Council Bill, Loughborough Corporation Bill, Workington Corporation Bill, Yeadon and Guiseley Gas Bill.

The Water Supply Bill, introduced by Mr. Cornwallis, the member for Maidstone, quite early in the session, to amend the law respecting the supply of water by companies and other bodies and persons, by giving more power to local authorities to inspect water areas, was down for second reading last Thursday; but on Tuesday the order was read and discharged, and the Bill withdrawn.

LEGAL INTELLIGENCE.

THE PATENT GAS ENRICHMENT SYNDICATE, LIMITED.

At Bankruptcy Buildings, Carey Street, Lincoln's Inn, on Monday last week, before Mr. Registrar Hood, a sitting was held for public inquiry into the circumstances connected with the promotion of the above-named Company and the conduct of its business. Mr. H. Brougham was in attendance as Official Receiver.

The first witness called was Mr. Thomas Fenwick, who stated that he carried on business at 63 and 64, New Broad Street, and described himself as a financial agent and merchant, but not as a company promoter. He had, however, promoted six or seven companies; but the only one which proved successful was the Insurance Corporation, Limited. Witness promoted the Patent Gas Enrichment Syndicate. The Articles of Association provided that the Board of Directors should consist of one Director present. The signatories were witness, Mr. Batcheler, Mr. Pugh, Miss L. Curtis, and three other lady clerks; and they each subscribed for one share, but did not pay for it. Miss Curtis, whose correct name was Miss L. White Curtis, was appointed Secretary of the Company. She was also Secretary of the Non-Tariff Mutual Insurance Company—another of his Companies—in the name of L. White. A prospectus was issued on Dec. 14, 1897, and it stated that the Company was formed primarily to acquire the valuable patent rights and special process for the manufacture of "Richolene," which was a superior gas-enriching spirit. The patent was taken out by a Mr. Dawes on Nov. 27, 1897, and was described as an improved apparatus for effecting the distillation and breaking up of liquid hydrocarbons and similar substances. Witness was not a chemist, and knew nothing about the patent. The particulars relating to it were given to him by Mr. Pugh, and witness put them into shape in the prospectus. Under an agreement dated Nov. 29, 1897, Mr. Pugh agreed to assign the patent to him, and witness was to form the Company and pay Mr. Pugh £100 in cash and £1000 in shares. On Dec. 14, 1897, witness agreed to sell the patent to the Company for £5000 in cash and £35,000 in shares. In the agreement he was described as an engineer. He had formerly practised as an engineer; but he supposed he adopted the description because the business was a mechanical one. By the agreement of Dec. 14, he agreed to pay the expenses connected with the promotion, to assign the patent to the Company, and to lay down an installation of plant. Witness received money from the Company, but paid nothing to Mr. Pugh. He was directly interested in the sale of the patent to the Company; but the fact that he was making a profit out of the sale was not disclosed in the prospectus. That document contained an estimate of profits amounting to £7395 per annum; and these figures were supplied to witness by Mr. Pugh. It was also stated that provision had been made for £5000 working capital; but witness said that unless the capital was fully subscribed, there would not have been any working capital. Reference was made in the prospectus to an apparatus for the distillation of the gas-enrichment spirit; but, so far as witness knew, no such apparatus had been made. Patent plant was also referred to in the prospectus; but there was none. The public were invited to subscribe for 2000 £10 shares and 2000 £10 debentures; and, as a result, applications were received for ten shares and two debentures. A second prospectus was then issued, with the object of obtaining further capital; the name of Mr. Batcheler—a Director who had resigned—being omitted. Eventually a third prospectus was issued; and altogether 158 shares and 32 debentures were allotted, in respect of which the Company received £1677 in cash. The third prospectus stated that considerable progress had been made with the works. On being asked what had been done, witness said a plot of land had been rented at Belvedere, and two second-hand iron sheds had been erected; the total cost being about £100, including labour. It was news to him that the apparatus could not have gone into the sheds; and he was not aware that the landlord, on distraining for rent, declined to take them even as a gift. No payment was made to Mr. Dawes in respect of the patent rights, and the Company never actually acquired the patent. Witness received, however, £1200 in cash; but he asserted that this was on account of the promotion expenses. He also received £7500 in debentures, which he transferred to certain clients who had lost money in his other companies. On Aug. 15, 1897, he agreed to accept £457, in addition to what he had already received, in settlement of his claim; and for this he was to assign the patent and complete a small installation of the works. He actually received £433, but did not assign the patent, as he alleged that the Company had not carried out the agreement. The Company commenced proceedings against a Mrs. Dainton to enforce payment of a call; but the action was not proceeded with. It appeared, however, that the lady obtained an order of the Court directing the Company to remove her name from the register, and to repay the sum paid by her in respect of shares, on the ground that she had been induced to apply for them by false and fraudulent representations and concealment of material facts in the prospectus. Witness denied that he controlled the Company. Of the £1694 received, witness had £1455, which included about £200 expended for stamps, &c.

The inquiry then terminated.

The Coal Contract of the Bury Corporation.

In the Court of Appeal last Thursday, before Lords Justices A. L. Smith and Vaughan Williams, the case of *The Hindley Field Coal Company, Limited, v. Gendall* was heard. It was an appeal by the defendant from an order of Mr. Justice Channell refusing to allow him leave to defend unless he paid £400 into court. The Company carry on business near Wigan; and the claim against the defendant, who was formerly the Manager of the Bury Gas-Works, was for £400, which sum, it was alleged, the Company had paid to the Bury Corporation at the defendant's request. In February of last year the Corporation brought an action against the Company and some other persons, including the defendant, to recover a large sum of money in respect of coals which the Company agreed to supply for the purposes of the gas-works; the Corporation alleging that the coal was not according to specification. The action was settled by the defendants; and the plaintiffs in the present action alleged that Mr. Gendall agreed to supply £400 which they paid on his behalf, and which they now sought to recover. The defendant denied that any such arrangement was come to, and refused to pay the amount. The whole question turned upon the correspondence which had passed between the solicitors to the parties. In the result the defendant was granted unconditional leave to defend, and the appeal was allowed.

Liabilities of Prepayment Meter Consumers.

At the South-Western Police Court, last Wednesday week, Samuel Hitchman, a working man, living at 75, Carpenter Street, Battersea, was summoned by The Gaslight and Coke Company for refusing to pay a sum of 4s. 7d. due for gas consumed. The defendant was provided with a penny-in-the-slot gas-meter, which had been broken open; and although it recorded the quantity of gas consumed, it only contained a little more than a shilling, whereas the amount due was 6s. 4d. The Company therefore sought to recover the balance. The defendant said the meter was broken open in his absence; and he claimed that he was not responsible. Mr. Humphreys, who represented the Company, said the tenant was legally responsible for the value of the gas consumed, even if the contents of a meter were stolen by robbers. There were thousands of prepayment gas-meters in use in London; and the Company felt compelled to take these proceedings. The Magistrate made an order for the payment of the amount claimed, with costs.

Embezzlement by a Water-Rate Collector.

At the Guildhall Police Court last Friday, Tom Robert Grace, 35, residing in Flaxfield Road, Brockley, was brought up on the charge of embezzling money belonging to his employers, the East London Water Company. Mr. Danby, who prosecuted, said the prisoner was collector of water-rates, and was paid by commission. In May last serious discrepancies were discovered, and he was asked to report himself to the Secretary at the Company's offices. A statement was prepared and signed by him to the effect that he had collected sums amounting to £481 9s. 7d. which he had not accounted for. As a matter of fact, the total amount was £500. Formal evidence having been taken, the prisoner pleaded "Guilty." It was stated that he had been in the service of the Company for thirteen years, and bore an excellent character. His commission amounted on an average to £300 a year. Mr. Jonas, who defended, said the accused had had domestic trouble, involving considerable expense. He pointed out that the Company would lose nothing, as the prisoner was in a Guarantee Society. Under the circumstances, he asked the Court to deal as leniently as possible with his client. Sir Marcus Samuel remarked that he was taking a very lenient course in not sending the accused for trial; and he would not be doing his duty if he sentenced him to less than six months' imprisonment with hard labour.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY.

Half-Yearly Report and Accounts.

The following is the report on the working of the Company in the six months ending June 30, which, with the accounts for this period, will be submitted to the proprietors at the half-yearly general meeting next Friday:—

The accounts for the past half year show that, after providing for the fixed charges, there remains a balance available for distribution of £506,888 5s. 9d., out of which the Directors recommend a dividend on the ordinary stock at the statutory rate of £4 18s. per cent. per annum; carrying forward the sum of £139,557 19s. to the credit of the current half year. This dividend is equivalent to one of £12 5s. per cent. per annum on the "A" ordinary stock as existing prior to its conversion by the Company's Act of 1898.

It is satisfactory to the Directors to be able to report that, notwithstanding the mildness of the weather during the early months of the year, there has been an increase in the quantity of gas sold during the half year of 174,586,000 cubic feet, equal to 1·6 per cent. In other departments the business of the Company has progressed satisfactorily.

Owing to the continued activity in the market for gas coal, and to the increase in the rates of freight, the prices at which contracts for the Company's supplies for the current twelve months have been made are higher than those of last year. The increases during the past two years have ranged, according to the quality of the coal, from 1s. 6d. to 2s. per ton. The Directors, however, are able to report that the increase in the revenue from residual products during the past half year has again been sufficient to meet the addition to the cost of coal.

The Company's Bill for further capital powers, which received the approval of the proprietors in January last, passed through all its stages in the House of Commons. Upon its coming before a Committee of the House of Lords, however, it was unfortunately rejected; their Lordships considering that the preamble of the Bill was not proved. The loss of this measure, which, as regards the mode in which the money was to be raised, was drawn with the fullest consideration for the interests of the consumers of gas, and against which no evidence was tendered in support of the opposing petitions, is greatly to be regretted, and has compelled the Directors to restrict the extension of labour-saving appliances and other contemplated improvements at the Company's several works, which have for their object increased economy in working.

The Committee of the House of Commons which was appointed last year to inquire into and to report on the powers of charge conferred by Parliament on the Metropolitan Gas Companies was re-appointed on the 9th of March of this year; Sir James Rankin, Bart., being the Chairman. It has held thirteen meetings for the purpose of hearing evidence on behalf of the Local Authorities of the Metropolis and of the Metropolitan Gas Companies respectively; and it is anticipated that its report will be presented to the House before the close of the session. [The Directors' report is dated the 19th ult. The report of the Committee, which will be found in another column, was not presented to the House until the 24th ult.—Ed. J.G.L.]

The Court of Directors has been furnished by the several Engineers of the manufacturing and distribution departments respectively with the usual certificates that all the Company's plant has been maintained in thorough efficiency.

Accompanying the report are the usual statements of account, which show the financial position of the Company under the Capital Consolidation Act of last session. We take therefrom the following particulars:—

The statement of capital (stock) on June 30 stands as follows: Total paid up, £9,216,500; added on conversion, £12,176,490; unissued, £250,000—total amount authorized, £21,642,990. The statement of loan capital stands thus: Total paid up, £2,644,000; added on conversion, £1,479,975; unissued, £200,000—total amount authorized, £4,323,975. The total stock and loan capital is therefore £25,966,965, of which £25,516,965 has been paid up.

The capital account shows receipts (with premiums, £1,603,050) to the amount of £27,120,015, of which £337,500, carrying £20,250 premium, was received in the past half year. The expenditure is shown in the following items:—

Expenditure to Dec. 31, 1898			£12,682,754 1 9
Expenditure during the half year to June 30, 1899, viz.:—			
Lands acquired, including law charges	£ 1,409 18 9		
Buildings and machinery in extension of works	17,182 8 5		
New and additional mains and service-pipes	23,925 12 10		
Do. do. meters	23,597 15 1		
Do. do. stoves	18,830 18 1		
	£84,946 13 2		
Cr. by value of plant demolished	18,680 0 0		
			(6,266 13 2
			£12,749,020 14 11
Nominal amount added on conversion			13,656,465 0 0
Balance of capital account			714,529 5 1
			£27,120,015 0 0

The revenue and net revenue accounts are given in full below.

Dr. REVENUE ACCOUNT. Cr.

June Half Year, 1898.		£ s. d.	£ s. d.	June Half Year, 1898.		£ s. d.	£ s. d.
	To Manufacture of Gas—				By Sale of Gas—		
£6 0,791	Coals, including oil, dues, carriage, unloading and trimming	682,741 7 10		£1,468,038	Common gas, per meter, at 3s. and 2s. 2d. per 1000 cubic feet	1,534,765 12 7	
14,357	Salaries of engineers and other officers at works	14,233 17 0		75,487	Public lighting and under contracts— Common gas	74,352 15 9	
162 921	Wages, carbonizing £161,547/13/10;	178,114 9 4		£1,543,515			1,609,118 8 4
16,307	„ sundries £16,566/15/6			16,098	Rental of stoves	..	21,324 18 0
34,352	Purification, including £17,023/3/6 for labour	34,677 7 9			Residual products—		
	Repair and maintenance of works and plant, materials and labour, less received for old materials,			£220,864	Coke, less £43,241 12s. 9d. for labour, &c.	286,749 14 8	
				5,527	Breeze, less £2415 15s. 11d. for ditto	8,345 17 11	
146,217	£3648 4s. 10d.	180,053 15 10		56,948	Tar and tar products	60,672 19 8	
			1,089,870 17 9	71,642	Ammoniacal liquor and sulphate of ammonia	82,462 13 4	
	Distribution of gas—						438,231 5 7
	Salaries and wages of Officers						
31,963	(including Rental Clerks)	33,343 3 8		£354,981			
	Repair and maintenance of mains						
46,218	and service-pipes	41,333 9 6		£4,391	Rents receivable		4,680 7 5
26,494	Repair and renewals of meters	25,117 6 9		242	Transfer fees		260 10 0
23,963	Stove fixing, repairs, and renewals	27,92) 3 11					
			127,664 3 10				
	Public lamps—						
16,630	Lighting and repairing	..	16,518 5 6				
	Rents, rates, and taxes—						
5,712	Rents payable	6,112 18 0					
108,753	Rates and taxes	112,915 4 5					
			119,023 2 5				
	Management—						
2,750	Directors' allowance	2,750 0 0					
200	Company's Auditors and Assis.ant	229 8 0					
	Salaries of Secretary, Accountant,						
10,089	and Clerks	11,714 3 1					
19.495	Collectors' commission	20,325 11 6					
6,943	Stationery and printing	6,734 8 3					
2,984	General charges	4,120 6 6					
			45,873 17 4				
2,984	Parliamentary charges	..	2,962 17 4				
1,532	Law charges	..	1,233 0 8				
5,286	Bad debts	..	5,252 13 3				
	Depreciation fund for works on lease-hold lands	..	500 0 0				
500	Annuities	..	12,193 16 9				
11,972	Workmen's Compensation Account	..	2,500 0 0				
..	Public Officers—						
882	Gas Referees and Official Auditor	878 18 10					
730	Public testing-stations	1,129 4 5					
			2,008 3 3				
£1,310,411			1,425,605 18 1				
608,816	Balance carried to net revenue account		648,009 11 8				
£1,919,227			2,073,615 9 4	£1,919,227			2,073,615 9 4

Dr. NET REVENUE ACCOUNT. Cr.

June Half Year, 1898.		£ s. d.	£ s. d.	June Half Year, 1898.		£ s. d.	£ s. d.
£64,159	To Interest on debenture stock and bonds, accrued to June 30, 1899	..	65,659 12 6	£303,484	By Balance from last account	416,495 15 0	
75,995	Dividend on the preference stocks— 4 per cent. consolidated	75,994 14 0		74,519	Amount withdrawn from reserve fund	..	
4	Convertible 5 per cent.	4 10 0		377,003		416,495 15 0	
45,500	Dividend on the 3½ per cent. maximum stock	45,500 0 0			Less dividend on the ordinary capital		
			121,499 4 0	377,003	for the half year to Dec. 31, 1898	362,736 11 9	
8,566	Interest on temporary loans & sundry funds		7,721 12 3				53,759 3 3
414,592	Balance applicable to dividend on the ordinary stock		506,888 5 9	608,816	Revenue account	..	648,009 11 3
£6.8,816			701,768 14 6	£608,816			£701,768 14 6

The balance available for division is £506,888 5s. 9d.; and the statement showing how the Directors propose to appropriate it is as follows:—

June, 1898.			
.. ..	Net balance brought from last account	£53,759 3 3	
£414,592 ..	Net revenue for the half year	453,129 2 6	
£414,592		£506,888 5 9	
(12½ per cent.)*	A dividend on the ordinary stock—		
£362,737 ..	£4 18s. per cent. per annum on £14,993,075 . .	367,330 6 9	
£51,855 ..	Balance carried to next account	£139,557 19 0	

* Equal to £4 18s. per cent. on the converted stock.

The three statements relating to the reserve, insurance, and depreciation funds show that the balances on June 30 were as follows: Reserve fund, £50,546; insurance fund, £82,369; depreciation fund, £52,606. The insurance fund had to bear in the past half year a sum of £101 19s. 1d., the value of plant destroyed by fires in the Company's district.

The statements furnishing particulars as to working are as follows:—

STATEMENT OF COALS USED, ETC.

Description of Coal.	In Store, 31st Dec., 1898.	Received during Half Year.	Carbonized during Half Year.	Used during Half Year.	In Store, 30th June, 1899.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common . .	238,557	860,047	974,421	4,220	119,463
Cannel . .	20,605	5,779	*7,698	..	18,686
Total . .	258,662	865,825	982,119	4,220	138,149

* In addition to this quantity of cannel 4,993,283 gallons of oil and spirit have been used during the half year.

STATEMENT OF RESIDUAL PRODUCTS.

Description.	In Store, 31st Dec., 1898.	Made during Half Year.	Used during Half Year.	Sold during Half Year.	In Store, 30th June, 1899.
Coke—tons	29,534	607,760	139,075	473,028	25,191
Breeze—tons.	1,979	65,819	19,725	47,689	384
Tar—gallons	904,430	10,135,739	10,239,288	16,280	784,601
Ammoniacal liquor—butts	23,596	278,941	270,154	..	32,383

STATEMENT OF GAS MADE, SOLD, ETC.

Quantity Made.	Quantity Sold.		Total Quantity accounted for.	Number of Public Lamps.
	Public Lights and under Contracts (estimated).	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	
*11,557,809	533,260	10,359,442	11,058,119	52,362
†11,467,617	525,127	10,192,989	10,869,475	52,259

* Including 1,526,972,000 cubic feet of "oil gas." † June half year, 1898.

The last statement is the general balance-sheet. It shows that the value of the stores on hand on June 30 was as follows: Coals, £94,029; coke, £14,489; tar and ammoniacal liquor products, £78,402; sundries, £282,570—total, £469,490. The figures for the corresponding period of 1898 were: Coals, £87,586; coke, £13,265; tar, &c., £92,896; sundries, £253,998—total, £447,745. The item "automatic meter supplies (fittings account)" amounts to £298,555, as compared with £296,374 in the six months ending June 30, 1898.

SOUTH METROPOLITAN GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report of the Directors of this Company for the six months ending June 30, which, with the accounts, will be presented at the half-yearly general meeting to-morrow week:—

The event of the year, in regard to the supply of gas to the Metropolis has been the appointment by the House of Commons of a Select Committee "to inquire into the powers of charge conferred by Parliament on the Metropolitan Gas Companies, and to report as to the method in which those powers have been exercised, having regard to the differences of price charged by the various Companies." Witnesses representing the Board of Trade, the City Corporation, the London County Council, some of the parishes in the North of London, and the three Metropolitan Gas Companies gave evidence before the Committee, whose sittings for this purpose extended over thirteen days—from April 20 to July 4; but the report of the Committee has not yet been published.*

The Directors have the pleasure to announce a second reduction this year of 1d. per 1000 cubic feet, to take effect from Midsummer last. They have been encouraged to take this step by the result of the half year's working, and by the effect of the Christmas reduction, which undoubtedly contributed to the satisfactory increase in the quantity of gas sold in comparison with the corresponding half year. This will bring the price down to 2s. 1d. per 1000 cubic feet to the ordinary consumers, and to 2s. 10d. to those supplied through the slot meters. The actual saving to the consumers by the two reductions will be over £80,000 a year.

There is, however, something to be said on the other side. In 1898 the Company's coal contracts were made just before the Welsh strike, at a small advance. This year the increased cost of coal and freight from the date of the renewal of the contracts in March is nearly 1s. 6d. per ton, which, on the twelve months' consumption of over a million tons, will entail an extra cost of about £70,000. This additional cost, coupled with the loss of revenue from the reduction of price, will require the maintenance of good prices for products, and great care and economy in management and working, to enable the Company to make receipts balance expenditure.

There is a balance on the revenue account of £192,174 1s. 8d., which, after meeting all charges for interest, paying the same dividend as before—viz., 5⅞ per cent., which the Directors recommend—adding the balance of divisible profit of 5s. 4d. per cent., or £7466 13s. 4d., to the reserve fund and carrying an amount equal to ½ per cent. on the capital for the half year, or £5787 10s., to the insurance fund, will leave £2545 17s. 2d. to be added to the balance brought forward; making the amount to be carried forward £29,855 17s. The reserve fund will then amount to £115,715 6s. 3d., and the insurance fund to £52,381 14s. 9d.; making a total, with the undivided balance, of £197,952 18s.

The officers and workmen generally, although there are some exceptions, show an increasing interest in the welfare of the Company. To their co-operation is due no small share of the Company's prosperity. They now share not only in its profits, but, being shareholders, also in its risks, and in the responsibilities of management.

Accompanying the report are the accounts. The first two statements relate to the stock and loan capital, and the third is the capital account. This, with the revenue and net revenue accounts, we give in full. Following these are the statements relating to the reserve, renewal, and insurance funds. They show that the balances on June 30 were as follows: Reserve fund, £108,248; renewal fund, £18,672; insurance fund, £52,381. The statements dealing with the manufacturing operations of the Company furnish the following particulars:—

STATEMENT OF COALS.

Description of Coal.	In Store, Dec. 31, 1898.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, June 30, 1899.
	Tons.	Tons.	Tons.	Tons.	Tons.
Newcastle coal . .	84,270	476,753	508,146	450	52,427
Cannel coal. . . .	1,343	325	†461*	—	1,207
	85,613	477,078	508,607	450	53,634

* 275,596 gallons of petroleum spirit used as a substitute for cannel.

STATEMENT OF RESIDUAL PRODUCTS.

——	In Store, Dec. 31, 1898.	Made during Half Year	Used in the Half Year.	Sold in the Half Year.	In Store, June 30, 1899.
Coke—cwts.*	285,155	6,260,664	1,303,345	5,157,776	84,698
Breeze—yards	5,462	122,287	17,344	109,168	1,247
Tar—gallons	378,694	5,000,636	76,527	4,858,905	443,898
Ammoniacal liquor—butts . .	18,153	157,006	113,307	47,340	14,512

* 1 cwt. of coke about equals 1 sack of 4 bushels, under "Weights and Measures Act, 1878."

STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity made.	Quantity Sold.		Total Quantity accounted for.	Number of Public Lamps.
		Public Lights (estimated).	Private Lights (per Meter).		
	Thousands.	Thousands.	Thousands.	Thousands.	
Common .	5,063,790	248,140	4,564,320	4,881,819	20,998

The remaining statement is the balance-sheet, which gives the value of the stores in hand as follows: Coals and enriching materials, £30,356; coke and breeze, £2709; tar, sulphate, and liquor, £7917; and sundries, £146,792. The figures this time last year were: Coals, &c., £9917; coke and breeze, £896; tar, &c., £4645; and sundries, £128,980. Among the accounts due to the Company is a balance of £19,988 for gas-fittings. A sum of £29,897, workmen's bonuses and savings, has been deposited with the Company; and the total of the officers' superannuation and guarantee funds is £38,266.

BRENTFORD GAS COMPANY.

[The Half-Yearly Report and Accounts.

In the report to be presented by the Directors of this Company at the half-yearly meeting next Friday, they state that the increase in the sale of gas during the six months ending June 30 was 8·28 per cent. over the corresponding period of 1898. The consumers of gas by the automatic-meter system continue to increase; the number of these meters in use in the Company's district at the close of the half year being 17,104, against 13,312 on June 30, 1898—equal to an increase of more than 28 per cent. for the year. Making the comparison as against June, 1897, the numbers are 17,104 now, compared with 9567 then, or above 78 per cent. in two years. The new manufacturing plant at the Southall works is now in complete working order. A further installation of similar plant is in process of erection at Southall, and will be ready for work by next winter. The entire plant of the Company (under the supervision of Mr. J. Husband, the Engineer and Manager) is reported to be in efficient condition. The Directors recommend the declaration of dividends at the following rates: 5 per cent. per annum on the preference stock, 12 per cent. per annum on the consolidated stock, and 9 per cent. per annum on the new stock, 1881.

The accounts accompanying the report show that the capital was increased by £30,040 (£15,000 of new stock and £15,040 premiums thereon) in the past six months; bringing it up to £1,011,180. The expenditure was £19,999, apportioned as follows: New buildings and machinery, £7393; mains and serviees, £4567; meters and stoves, £8039. The total expenditure on capital account has been £995,389; leaving a balance of £15,791. The revenue account shows that the sale of gas produced

* The report has now been issued, and will be found elsewhere.—ED. J.G.L.

SOUTH METROPOLITAN GAS COMPANY.

CAPITAL ACCOUNT.

	£ s. d.	£ s. d.
Capital account to Dec. 31, 1898	..	3,780,199 1 4
Expenditure during half year to June 30, 1899—		
New buildings and machinery in extension of works	5,873 0 10	
New and additional mains and services	15,478 16 3	
New and additional meters	11,729 11 9	
New and additional stoves	12,989 14 11	
		46,070 8 9
Total expenditure		3,826,269 5 1
Balance		131,556 1 7
		3,957,825 6 8
Nominal amount added by conversion		3,851,666 13 4
Total		7,809,492 0 0

Description of Capital.	Certified to Dec. 31, 1898.	Received since that date.	Total.
	£ s. d.	£ s. d.	£ s. d.
Ordinary stock	2,315,000 0 0	..	2,315,000 0 0
Premium on do.	414,332 0 0	..	414,332 0 0
Debenture stock	893,333 6 8	60,000 0 0	953,333 6 8
Premium on do.	274,154 0 0	1,006 0 0	275,160 0 0
Total	3,896,819 6 8	61,006 0 0	3,957,825 6 8
Nominal amount added by conversion—			
Ordinary		£3,285,000 0 0	
Debenture		566,666 13 4	
			3,851,666 13 4
Total			7,809,492 0 0

REVENUE ACCOUNT.

To Manufacture of gas—			
Coal into store, including cost of petroleum spirit for enriching and including £21,100 8s. 8d. for labour	£285,505 2 5		
Purification, including £5794 2s. for labour	13,434 14 8		
Salaries of Engineer and Officers at works	8,067 14 11		
Wages (carbonizing)	54,021 18 2		
Repair and maintenance of works and plant, including £40,494 15s. 4d. for labour, less £2007 11s. 5d. received for old materials	87,063 0 2		
		£448,092 10 4	
Profit sharing for 12 months to June 30, 1899	21,027 18 2		
Less on account, Dec. 31, 1898	9,000 0 0		
		12,027 18 2	
Distribution of gas—			
Repair, maintenance, and renewal of mains and service-pipes, including £11,969 11s. 8d. for labour	19,521 9 8		
Salaries, &c., Officers and Rental Clerks	11,219 18 9		
Repairs, &c., of meters (£2130 7s. 2d. for labour)	10,651 9 3		
Repairs, &c., of stoves (£5404 9s. 1d. for labour)	11,457 13 6		
Gas-fittings (labour)	4,328 7 7		
		57,178 18 9	
Public lamps—Lighting and repairing (including £6040 9s. 4d. for labour		10,221 8 8	
Rents, rates, and taxes—			
Rents payable	£956 18 6		
Rents and Taxes	28,271 16 7		
		29,128 15 1	
Management—			
Directors' allowance	£1,788 12 10		
Salaries of Secretary, Accountant, and Clerks	2,366 1 5		
Collectors	8,718 7 10		
Stationery and printing	2,014 16 11		
General charges	3,398 17 11		
Company's Auditors	112 10 0		
		18,299 6 11	
Law charges	767 19 0		
Parliamentary charges	21 0 0		
		788 19 0	
Bad debts		1,351 18 3	
Pensions and officers' and men's superannuation and sick funds		5,560 15 6	
Gas Referees and Official Auditor		360 16 5	
Leasehold Renewal Funds		300 0 0	
Total expenditure		£583,720 7 1	
Balance carried to net revenue account		192,174 1 8	
		£775,894 8 9	

By Sale of gas—			
Lady Day, at 2s. 2d. per 1000 feet	£298,750 3 3		
Midsummer, at 2s. 2d. per 1000 feet	190,623 1 11		
	£489,373 5 2		
Public Lighting and under contracts, including Lighting, Repairing, &c., £10,621 8s. 8d.	32,178 0 3		
		£521,551 5 5	
Meters in use: 189,144—			
Company's Meters at rent: Ordinary, 91,578; automatic, 86,573	£17,104 19 9		
Company's stoves at rent: Ordinary, 43,377; automatic, 68,134; fires, 8947	12,218 18 6		
		29,323 18 3	
Residual products—			
Coke, less £1467 12s. 4d. for cartage; £13,920 5s. 5d. labour, &c.	157,567 5 9		
Breeze, less £720 10s. 11d. for cartage; £2044 12s. 11d. labour, &c.	9,061 11 9		
Tar, less £128 7s. 4d. for cartage; £805 9s. 10d. labour, &c.	16,995 8 11		
Ammoniacal liquor, less £976 11s. labour, &c.	8,947 5 0		
Sulphate of ammonia, less £2966 11s. 4d. for acid, &c.; £5833 16s. 7d. labour, &c.	31,051 14 3		
		223,626 5 8	
Rents receivable		1,818 9 5	
Transfer fees		74 10 0	
Total Receipts		£775,894 8 9	

PROFIT AND LOSS (NET REVENUE) ACCOUNT.

Interest on temporary loan and deposits		£4,820 12 3	
Interest on debenture stock		22,650 0 0	
Amount carried to insurance fund		5,787 10 0	
Balance applicable to dividend on the ordidary stock		186,655 17 0	
		£219,913 19 3	
Balance from last account			£181,309 19 10
Less dividend for the half-year ended Dec. 31, 1898	£149,333 6 8		
Divisible profit carried to reserve fund	4,666 13 4		154,000 0 0
			£27,309 19 10
Amount from revenue account			192,174 1 8
Interest on banker's balances			429 17 9
			£219,913 19 3

£119,683, compared with £110,503 in the first half of 1898; meter and stove rents were £9413, against £8072; residuals brought in £27,410, against £22,203; and the total receipts were £156,553, against £140,818. On the other side of the account, coals cost £57,889, compared with £50,067; wages came to £8271, against £7610; and repairs, to £12,195, against £9704—the total manufacturing expenses being £82,352, compared with £71,360. The other important items of expenditure were: Distribution, £16,710; public lamps, £2243; rents, rates, and taxes, £7782; management, £5066—the total expenditure being £115,966, against £102,040. The balance carried to the profit and loss account is £40,587, compared with £38,778 this time last year. The statements as to the Company's manufacturing operations show that in the past six months 70,198 tons of Newcastle coal, 155 tons of cannel, and "Solar" oil equal to 13,430 tons of coal were used for the production of gas; the quantity made being 879,799,000 cubic feet, of which 809,222,000 cubic feet were sold and 822,222,000 cubic feet accounted for. For the first half of 1898, the figures were: Gas made, 806,022,000 cubic feet; sold, 747,359,000 cubic feet; accounted for, 759,859,000 cubic feet. The estimated quantities of residuals made during the six months ending June 30 were: Coke, 46,908 tons; breeze, 5877 tons; tar, 762,930 gallons; ammoniacal liquor, 2,042,820 gallons.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Half-Yearly Report and Accounts.

In the report to be presented by the Directors of this Company at the half-yearly general meeting next Friday, they point out that for the last four years—since Midsummer, 1895—the price of the Company's gas has remained stationary at 2s. 7d. per 1000 cubic feet; and to maintain it at this figure large amounts have year by year been withdrawn from the reserves. In 1889 the price was reduced to 2s. 6d.; and in 1892 the great increase in the cost of coal and labour, which had been growing since 1889, necessitated an increase to 2s. 9d. The growth of the business—nearly 7 per cent. over the corresponding half year—the good prices realized for products, and the improvement in working the concern, notwithstanding a material addition to the cost of coal, have resulted in an amount of surplus profits in the past half year which gives promise that the Directors may shortly be able to announce a reduction in the price of gas. The reserve fund in 1895 stood at above £40,000; it now stands at £34,560. The lowest point reached in 1898 was £32,435. The Directors consider it to be proper to gradually restore the fund to its former maximum; and with this object in view, they recommend that the one-eighth per cent. of dividend unpaid should, with the accruing interest, be added to the fund. To meet the growing demand for gas, and led thereto by the increasing cost of coal, the Directors have ordered an installation of carburetted water gas to be ready for the coming winter. The balance applicable for distribution is £18,791; and the Directors recommend the payment of the same dividends as last year, at the following rates per annum—viz., 5 per cent. on the preference stock and 5¼ per cent. on the ordinary stock, less income-tax.

The accounts accompanying the report show that a sum of £12,886 was spent for capital purposes in the six months ending June 30; £7177 being for new buildings and plant, £1960 for new mains and service-pipes, and about £3700 for new meters and stoves. The total expenditure on capital account to the above-named date has been £698,058; and there is an unexpended balance of £21,524. The revenue from the sale of gas amounted to £70,046; the rental of meters (14,716 ordinary and 8826 prepayment), to £1720; the rental of stoves (5753 ordinary and 6816 prepayment), to £1464; residuals returned, £24,087; and the total revenue was £97,328. The expenditure on manufacture was £61,262 (coals, carburine, and labour costing £39,675); on distribution, £8043; on management, £3385; and the total expenses

were £77,760—leaving a balance of £19,568 to go to the net revenue account. Under the supervision of Mr. S. Y. Shoubridge, the works produced 580,599,000 cubic feet of gas, of which 547,415,000 cubic feet were sold; the raw material used being 56,927 tons of coal, 40 tons of cannel, and 7776 gallons of carburine. The quantities of residuals produced in the half year were: coke, 712,087 cwt.; breeze, 11,520 yards; tar, 546,078 gallons; and ammoniacal liquor, 12,101 butts. There were 566 tons of sulphate of ammonia made, and 552 tons sold, in the six months covered by the accounts.

MANCHESTER CORPORATION GAS SUPPLY.

Annual Report and Accounts.

We have received from the Superintendent of the Manchester Corporation Gas Department (Mr. Charles Nickson) a copy of the report of the Gas Committee, with an abstract of the accounts for the year ending March 31 last. The Committee record the progress of the undertaking as follows:—

The number of tons of coal and cannel carbonized, including the equivalents of enriching material, and quantity of gas and residual products made per ton carbonized, compared with the previous year, is—

	Coal and Cannel Carbonized. Tons.	Gas per Ton. Cub. Ft.	Coke per Ton. Cwt.	Coke For Sale per Ton. Cwt.	Tar per Ton. Gallons.	Am Liq. per Ton. Galls. (10 oz.)
1899.	426,831	10,445	12·97	8·79	12·10	27·60
1898.	407,236	10,210	12·82	8·39	12·44	28·06

The illuminating power of the gas sent from the works was equivalent to 19·36 standard sperm candles, as against 19·51 candles for the year 1897-8.

The quantity of gas transmitted from the works shows an increase of 303,553,000 cubic feet, or 7·31 per cent., as compared with a decrease of 28,819,000 cubic feet, or 0·69 per cent. in the previous year. The total output and quantity unaccounted for, compared with 1897-8, is as follows:—

	Gas Sent Out. Cub. Ft.	Unaccounted for. Cub. Ft.	Percentage of Loss.
1899	4,457,073,000	171,735,000	3·85
1898	4,153,520,000	148,549,000	3 58

The number of gas consumers on March 31, 1898, and 1899, was respectively as follows:—

	Within the City.	Beyond the City.	Total.
1899	97,312	21,646	118,958
1898	92,082	20,181	112,263
Increase in 1899	5,230	1,465	6,695

The percentage of private consumption was as follows:—

	1898. Per Cent.	1899. Per Cent.
Within the city—Ordinary consumers	82·26	80·98
Prepayment ,,	3·05	4·00
Outside the city—Ordinary ,,	14·51	14·74
Prepayment ,,	0·18	0·28
	100·00	100·00

The use of prepayment meters is still extending. The number of these meters in service at the end of the financial year was 26,751, as compared with 22,761 in the previous year—an increase of 3990, of which 3457 have been fixed in the city and 533 in the out-townships. The quantity of gas consumed by these meters was 167,273,000 cubic feet—an increase of 50,086,000 cubic feet, or 42·74 per cent. on the previous year.

The application of gas for purposes other than lighting continues to increase. The number of gas fires, cookers, and other appliances on hire at the 31st of March was 7336, and the number of gas-engines in use 1375, as compared with 5188 and 1257 respectively for the year ended March 31, 1898. The quantity of gas used by cookers, fires, and engines is estimated at 310 million cubic feet; being an increase of 8·77 per cent. on the figures for 1897-8.

The total amount of revenue last year was £594,970, as compared with £553,642 in 1897-8; being an increase of £41,328. The revenue was derived as follows:—

	1898.	1899.
Gas-rentals, &c., within the city	£386,952	£413,942
Do. beyond the city	83,029	84,215
Coke	39,668	48,362
Tar	24,409	24,568
Ammonia water	19,071	23,357
Sundry receipts	513	526
	£553,642	£594,970

The amount paid for coal, cannel, and oil, including the cost of unloading, was £231,176. The cost of this material per ton carbonized was 10s. 9·98d., against 10s. 10·38d. for the previous year—a gain to the Committee of 0·40d. per ton, which on the total carbonization of 426,831 tons amounts to £711. The whole of the works and plant have been kept in a state of thorough repair out of revenue.

The gross profit on the year's working was £139,052 8s. 7d. The sum of £37,078 15s. 9d. was paid for interest; and £27,921 2s. has been placed to the sinking fund (as required by the Acts of Parliament under which the money is borrowed). The net profit, therefore, amounted to £74,052 10s. 10d. Of this amount, £51,200 was paid over to the city fund; £1192 18s. 4d. has been placed to the suspense account, on account of the outlay on carburetted water-gas plant; and the balance, £21,659 12s. 6d., has been carried to the contingent fund.

The expenditure on capital and renewals accounts was as follows:—

	Capital.	Renewals.
Gaythorn	£3,244 5 6	£3 970 4 3
Rochdale Road	5,389 14 4	4,348 7 8
Bradford Road	8,866 7 8	335 0 0
Droylsden	20 8 7	—
Street-mains	17,001 12 0	8,752 4 8
Service-pipes	6,674 10 0	2,860 4 9
Meters	25,522 13 7	5,000 0 0
Stoves	14,194 6 6	255 3 4
Stoves show-room, Deansgate	29 8 5	—
Oil storage depôt (Mode Wheel)	505 13 4	—
Land and property	31 1 11	—
	£81,480 1 10	£25,521 4 8

No. 1 retort-house at the Gaythorn station has been reconstructed and fitted with 18 settings of inclined retorts—six in each setting—with regenerator furnaces. The coal is broken, elevated, and conveyed into continuous bunkers by machinery; and the retorts are charged by means of travelling shoots. The coke is removed by a drag-chain conveyor, and elevated into hoppers for loading carts. This installation of inclined retorts has been at work since August, 1898, and when the difficulties incidental to new plant and arrangements, which can only be ascertained in practical working, have been overcome, it is expected that the anticipations as to economy and success will be fully realized. The Committee have decided to remove the eighteen old scrubbers, which are much out of condition, and substitute for them a Livesey washer, an extractor tower, and a washer-scrubber, each of improved construction and more efficient working power. The first portion of this work will be proceeded with and completed during the present summer.

The manufacture of gas at the Rochdale Road station has progressed without mishap to any portion of the plant; a satisfactory yield of gas has been realized; and the cost of manufacture has been kept low. The re-arrangement of these works, and the important alterations decided upon (including the conversion of the old "A" retort-house into a meter-house, governor-house, and mechanics shop and smithy), and the requisite alterations of the connecting mains for the meters, governors, and gasholders, and the building of the new valve-house, is being proceeded with, and rapidly approaching completion. The process of lime purification was commenced on the 6th of April, and has effected a very satisfactory reduction in the quantity of sulphur compounds and other impurities contained in the gas.

The manufacture of both coal gas and carburetted water gas at the Bradford Road station has proceeded with great regularity and satisfaction to the Committee during the past year. The eight new purifiers, the two new boilers, and the new boiler-house, which were in course of erection last year, have been completed, and were fully available for work during the winter. In the production of carburetted water gas, 1,532,619 gallons of oil and 7809 tons of coke have been used. The total production of carburetted water gas during the year was 381,055,000 cubic feet. The use of this gas has tended to increase the illuminating power and purity of the gas sent out from the works; and its admixture with the ordinary coal gas has been in every way satisfactory. It is intended, on as early a date as possible, to erect, and fully equip with the best appliances, a new experimental coal-testing works at this station, plans and specifications for which have already been prepared by the Engineer.

The small works at Droylsden have been maintained in good working condition; and the method of purification some time ago adopted here secures that well-purified gas of good illuminating power shall be distributed in the district.

A large increase in the consumption of gas continues. During the past five years the increase has been as follows:—

	Cubic Feet.	Increase Per Cent.
Year ended March, 1895	151,032,000	4·28
1896	79,503,000	2·16
1897	419,769,000	11·16
1898 (decrease)	28,819,000	0·69
1899	303,553,000	7·31
Average	185,000,000	5·24

From the end of March last to the end of June, the increase has been 9·58 per cent. over the corresponding period of last year. The attention of the Committee and their Engineer is being given to an extension of manufacturing plant on an early date, so as to be prepared to meet the increasing demand. To obtain the requisite capital for this purpose, application was recently made to increase the borrowing powers for the gas undertaking by an additional £500,000. This application has been approved and confirmed by Parliament; and the requisite steps will be taken to obtain the funds for such additional buildings, plant, and machinery as may be from time to time decided upon.

The street mains and services have been kept in good condition during the past year. The continued demand for prepayment meters, gas-cookers, and gas-fires has added much to the work of the department; and all applications for supply have been attended to as promptly as possible. The new independent mains, by which gas can be transmitted to and from each of the works and thence distributed into the various districts, are now practically completed, and the work has been carried out most successfully; thus ensuring the distribution of a regular and abundant supply of gas. The total length of mains now laid is 1,383,811 yards, or 786¼ miles and 11 yards.

The following is a summary of the past year's transactions in the stoves department compared with the previous year:—

	1898.	1899.
Number of articles sold	947	1179
New cookers and heaters purchased	1454	2489
Stoves issued on ordinary hire (including new stoves and re-issues)	2312	3674
Stoves issued on the hire-purchase system	63	35
Stoves cleaned and repaired	874	962

Accompanying the report are the accounts and the usual appendices, from which we take the following particulars:—

PROFIT AND LOSS ACCOUNT.

INCOME.

Gas-rental—			
Ordinary meters		£429,974 12	10
Prepayment meters		25,239 11	2
Public lamps		37,636 0	4
Meter-rents (beyond the city)		1,678 13	10
Stove-hire		3,627 12	10
Residual products—			
Coke	£48,362 9 4		
Tar	24,567 16 6		
Ammonia water	23,356 12 8		
Carbon	201 10 10		
		96,488 9	4
Rents of cottages, &c.		324 10	0
		£594,969 10	4

EXPENDITURE.

Cannel and coal (including cost of unloading, &c.)	£231,176 1 4
Carbonization (retort men's wages, &c.)	50,213 16 9
Retorts, fire-bricks, &c. (including cost of setting)	10,847 4 9
Repairs and maintenance of works, mains, &c.	62,412 4 9
Renewals of plant, &c.	25,521 4 8
Purifying material and wages	5,247 14 9
Salaries and wages of clerks in Superintendent's office, rental and inquiry offices, and meter inspectors	22 863 1 9
Collectors', receivers', and cashiers' salaries	8,541 18 5
Rents, rates, and taxes	32,372 13 0
Compensation under the Workmen's Compensation Act, 1897	568 10 7
Bad debts	631 16 0
Miscellaneous expenses	5,520 15 0
	£455,917 1 9
Balance	139,052 8 7
	£594,969 10 4

Interest	£37,078 15 9
Sinking funds	27,921 2 0
Balance (net profit on the year's working)	74,052 10 10
	£139,052 8 7

The balance of net profit is applied as follows:—

Amount paid over to the city fund account	£51,200	0	0
Suspense account in connection with expenditure on carburetted water-gas plant	1,192	18	4
Balance placed to contingent fund	21,659	12	6
	£74,052	10	10

The appendices following the accounts furnish, as usual, statistics as to the progress of the gas undertaking during the year.

The figures in Appendix A—a statement of the lamp and private rental, including meter and stove rents, derived from within and beyond the city—have already been given in the profit and loss account.

Appendix B is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows:—

	Daytime. Cubic Feet.		Twenty-four Hours. Cubic Feet.
Year ended March 31, 1898.	1,103,229,000	..	4,153,520,000
Do. do. 1899.	1,188,340,000	..	4,457,073,000
Increase	85,111,000	..	303,553,000

	Cubic Feet.
Quantity of gas transmitted from works	4,457,073,000
Do. measured and accounted for	4,285,338,000
Loss (by condensation and leakage)	171,735,000, or 3·85 per cent.

In Appendix C, particulars are given as to the results of the working from June 24, 1880, to March 31, 1889. The table contains statistics as to the number of tons of coal carbonized, the total make of gas, the percentage unaccountable for, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., for each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 426,831 tons; gas made, 4,458,116,000 cubic feet; yield per ton of coal carbonized, 10,445 cubic feet; illuminating power, 19·36 candles; make reduced to 20-candle power, 4,315,456,000 cubic feet; make per ton, 20-candle power, 10,110 cubic feet; make of coke, 253,591 tons; do. per ton of coal, 12·97 cwt.; make of tar, 25,576 tons; do. per ton of coal, 12·10 gallons; make of ammoniacal liquor (10-oz. strength), 10,793,448 gallons; do. per ton of coal, 27·60 gallons.

Appendix D shows the number of stoves on hire and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 5057 stoves on hire within, and 2279 beyond the city—together, 7336, as compared with 3760 and 1428 (together 5188) at the corresponding date in 1898; so that there was an increase of 2148. The number of meters in use was 118,958 in 1899, and 112,263 in 1898. There was last year a net increase of 6695 on the number for the preceding year. Of the total number at work on March 31 last, 112,076 were on hire, as compared with 104,752 at the close of the financial year 1897-8. The number of prepayment meters on hire on March 31 last was 26,751—an increase of 3990 on the number at the close of the preceding year.

From Appendix E we learn that the gas-mains laid last year within the city amounted to 36,179 yards, and beyond the city to 12,704 yards—a total of 48,883 yards, or 27¾ miles 43 yards. The mains taken up were 14,242 and 2138 yards respectively—a total of 16,380 yards, or 9¼ miles 100 yards. The total net increase during the year, therefore, was 32,503 yards, or 18½ miles 383 yards. The total length of mains laid at March last was 1,383,811 yards, or 786¼ miles 11 yards.

Appendix F consists of a statement showing the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from 1862 to March 31 last. The figures for the past financial year are as follows: Profit, £139,052; paid over for improvement purposes, £51,200; carried to contingent fund, £21,659; borrowed money owing, £1,090,345; and excess of assets, £1,068,183. The profit of £139,052 is appropriated thus: Interest, £37,079; liquidation of mortgage debt, £27,921—leaving a surplus of £74,052.

The accounts will come before the Council at their meeting to morrow.

EDINBURGH AND LEITH GAS COMMISSION.

The Engineer's Salary—The Sinking Fund.

A Meeting of the Edinburgh and Leith Gas Commission was held on Monday, the 24th ult.—Bailie KINLOCH ANDERSON presiding. The report presented by the Engineer (Mr. W. R. Herring) showed that in the month of June the output of gas was 70,465,000 cubic feet—an increase of 3,280,800 cubic feet upon the corresponding month of last year. Since the 16th of May, the increase has been 7,724,900 cubic feet. During June 292 gas-cookers were fixed; and since the 16th of May the number has been 500.

The CHAIRMAN said that the Works Committee had had an interim report by a Sub-Committee on the Granton works before them. Generally, the work was proceeding only fairly expeditiously. They had to make a little complaint as to the principal contractor not getting on quickly enough—in fact, not having as large a plant on the ground as Mr. Herring thought necessary. However, he had promised to do better; and although that portion of the work (the gasholder-tank) would probably be a little late, it might not be much. They had accepted the tender of Messrs. Clayton, Son, and Co., Limited, of Leeds, for the construction of a gasholder (of 6½ million cubic feet capacity), at the price of £43,315. There were a number of tenders quite close to each other; but this one was the lowest. A Sub-Committee had also reported with reference to the Engineer's salary that, "keeping in view that the erection of entirely new works for the Commissioners was not in contemplation when the terms of Mr. Herring's appointment were arranged in February, 1897, and the magnitude of these operations, which have already imposed upon Mr. Herring's very important and arduous labour, that will continue for possibly six or seven years yet, the Committee recommend that Mr. Herring's salary should, as from Whitsunday last, be raised to £1200 a year; and that, so soon as Mr. Reginald Macleod ceases to be tenant of Granton House and grounds, Mr. Herring should be allowed to occupy these free of rent and taxes." The Works Committee approved of the report unanimously. Everyone was thoroughly satisfied that Mr. Herring deserved further recognition at their hands, for his most valuable services, and his devotion to the Commissioners' interests.

The Commission adopted the recommendation of the Works Committee.

The Finance and Law Committee recommended the Commissioners to allow and certify the annual accounts of the Commissioners: To set apart for the mortgage and annuity sinking funds the minimum contributions of £2298 11s., and £7249 15s.; to carry forward to next year the balance of £21,608 1s.; to write off £3430 17s.—being the expense of the Commissioners' Act of 1898—by using the reserve fund of £3280 8s., by debiting the balance of £150 8s. to the balance carried forward; and to debit to the same balance £821 15s., being the expense of the title to the Granton property.

Mr. JOHN JAMIESON said he proposed, as he did a year ago, that instead of laying aside 15s. per cent. for redemption of annuities, they should lay aside 20s. per cent. He would like very much to see such a policy adopted in future years. The Commissioners were entering upon a new departure, in the erection of new works; and although nothing had yet been said in the Commission about the option they had of suspending the operation of the sinking fund for five years, he thought it likely they would suspend, and he thought this was an additional reason for their laying aside a larger proportion to the sinking fund. During the last four years, their additions to capital had been very much larger, in proportion, than their additions to the sinking fund; whereas, in the four years previous to that, their additions to the sinking fund were considerably more than their additions to capital. So that, if they put the one view against the other, they were proceeding upon rather less safe lines, in the building up of the sinking fund, than they had been doing formerly. He was the last to wish to see the price of gas raised to the consumers; but he thought it was an altogether bad policy, and against experience, to go on the principle that the present year was to pay for other years. In fact, it was against their standing orders. He would have liked to have gone further and have proposed that they should wipe something off the suspense account; but he contented himself with moving this addition to the sinking fund for the redemption of annuities.

Bailie MACKIE seconded. He thought they should increase their sinking fund whenever they had the opportunity.

Bailie MANCLARK moved the recommendation of the Committee—that was, to lay aside what Parliament had arranged for. They did not anticipate every year going into new works; and if, this year, they were to lay aside £2400 more, they might require to borrow money in lieu of it. He thought it would be very bad policy just now to do more than Parliament required them.

Mr. BRYSON seconded.

The CHAIRMAN thought it would surely be a very short-sighted policy to lay away more money than they were required to, and, at the same time, to have to pay heavy interest for borrowed money. This money would be in their own hands, to be used by them if they should want it.

The recommendation of the Committee was adopted by 9 votes to 3.

The TREASURER (Mr. John S. Gibb) read the certificate of the Auditor, with reference to the annual accounts of the Commissioners. The Auditor (Mr. H. Kenward Shiells, C.A., Edinburgh) was re-appointed.

Mr. HERRING intimated that he had received a petition from the retort-house workers for an increase of wages by ½d. per hour, and for time-and a-half for Sunday labour. The petition was sent to the Works Committee and it was agreed, in view of the Commissioners not sitting again till the end of September, that, in the event of the Committee agreeing to give the increase, it could be made retrospective.

IS BIRMINGHAM GAS DEAR?

Further Figures from Widnes.

In last week's issue, there appeared an article under the above title taken from the "Birmingham Post." The writing of the article was prompted by correspondence in the columns of our contemporary, in which comparisons had been made of the price of gas in the city and that charged at Widnes.

Lack of information at the time compelled the writer to pass over in a very cursory manner the conditions which exist at Widnes; and the deficiency has since been supplied by Mr. Isaac Carr, the Engineer of the gas-works of that town. He writes: "An article in your issue of the 20th inst. under the above heading makes a comparison of the gas supplies in a number of towns with that of Birmingham; but the results at Widnes—the case which provoked this article and previous letters—were passed over with the statement that recent figures had not been obtainable, and, quoting from a Parliamentary Return for 1897, gives the selling price of gas to consumers within the borough at 1s. 8d. and 1s. 10d., while those outside were called upon to pay 1s. 10d. and 3s. The article further states that the charges inside the borough have since been reduced to the figures which have attracted general attention; but there is no statement as to outside charges. The quantity of gas sold outside the borough of Widnes at the high rates mentioned is 4 per cent. on the total consumption; and the higher prices amount to ¼d. per 1000 cubic feet on the total sales. The prices mentioned in the Parliamentary Return being subject to a discount of 2d. per 1000 feet, brought down the actual average receipts throughout the whole district of supply in 1897 to 1s. 7¼d. per 1000 cubic feet—a figure very much lower than your statement would lead readers to suppose. With the subsequent reductions, the actual average receipts, both inside and outside the borough, will be 1s. 4¼d. per 1000 feet. The slot-meter consumers take 15 per cent. of the total gas sold at 38 cubic feet per 1d., which is the ordinary selling price—*i.e.*, 1s. 5d. per 1000 feet, *plus* the interest and depreciation on the cost of internal pipes and fittings, grillers, and meters, which are supplied and fixed free, together with the extra cost of collection. Meter and stove rents are charged to ordinary consumers, which amount to 0·72d. per 1000 cubic feet; about half being for gas-meters. As the illuminating power of the two gases is practically the same, the cost of production at Birmingham is nearly three times that of Widnes—*i.e.*, 15·23d. per 1000 feet, against 5·18d. The total cost at Widnes, including standing and all other charges, is 12·213d., against 23·99d. for Birmingham. It will, therefore, be seen that the Widnes Corporation are now in a position to sell gas at 1s. 1d. per 1000 cubic feet throughout their whole district of supply were it not for the large sums appropriated for the relief of the general district rate and increasing the sinking fund beyond the requirements of the Act."

LEICESTER CORPORATION GAS AND ELECTRICITY SUPPLY.

Adoption of Water Gas.—Half-Yearly Report.

At a Meeting of the Leicester Town Council last Tuesday—the Mayor (Dr. Clifton) presiding—the Gas and Electric Lighting Committee submitted a report in which they stated that they had been for some time considering the desirability of erecting water-gas plant, as an alternative method of producing gas, and for supplementing the existing coal-gas supply. A deputation, with the Engineer (Mr. A. Colson), had visited several towns where water-gas plant was in operation with satisfactory results. The Committee were of opinion, also bearing in mind the great advance in the price of coal, that the time had arrived when similar works could with advantage be erected in Leicester. The Council had power to borrow £250,000 for the purposes of the gas undertaking, of which borrowing power £113,112 was still unexercised; and the Committee recommended that a plant be laid down at the Aylestone Road works capable of producing about 3 million cubic feet of gas per day. Mr. Colson estimated the cost of this work at £40,067. Regarding the manufacturing operations during the six months ending June 30 last, the report states that 73,555 tons of coal were carbonized. The quantity of gas made was 752,850,000 cubic feet, as against 708,164,000 cubic feet in the corresponding week of the previous year; being an increase of 44,686,000 cubic feet, or 6·31 per cent. The average illuminating power of the gas for the same period has been as follows: Belgrave Gate works 17·11 sperm candles, Aylestone Road works 17·12. The total output of electric current from the central station for the half year ending June 30 last was 342,327 units, as against 224,642 units in the corresponding period of last year—an increase of 117,685 units, or 52·38 per cent.

Alderman Lennard, in moving the adoption of the report, observed that two years ago the Committee came before the Council with similar plans for expansion. The present total capacity was about 9 million cubic feet per day; and it had been thought that this would suffice for some years. But circumstances had forced their hands; and the Committee now considered themselves justified in going in for this further extension. There were two main reasons for this: One was the rapid extension of the use of gas in the town, and the other was the advance in the price of coal. There had been a great increase in the number of gas-stoves used in the borough; the average number of orders being 260 a week. About six weeks ago orders came in for no fewer than 290 stoves in one day. The increase in the consumption of gas in Leicester during recent years had been enormous. In the first half of 1895—when they first began to supply electricity, the consumption of gas was 597,894,000 cubic feet, as compared with 752,850,000 feet in the first half of 1899, being an increase of 154,956,000 cubic feet, or nearly 26 per cent. (25·91) in four years; and this notwithstanding the introduction during that period of the electric light. The latter illuminant had also made enormous strides, the consumption in the first half of 1895 being 31,379 units, as compared with 342,327 units in the first half of the present year, or more than a tenfold increase in the four years. Was this increase likely to continue? Whether the town increased or not, the demand for electric light would increase, as the price had been reduced from 5d. to 4d. per unit for light, and from 3d. to 2d. per unit for power. He was sure this reduction would give a considerable impetus to the demand for electric light, which at present the Committee would be able to cope with. They would get over this winter all right; but it would be his duty in two months to ask the Council to borrow £100,000 for distributing-mains, &c., which would last them about five years. As they were aware, these items of expenditure did not trouble the rates at all. The increased demand for gas would depend on the growth of the town. In 1890, the first water-gas plant was erected in London; and like many fresh things it came from America, where it was very largely used. Since then 57 towns in England had adopted it, as an alternative system to coal gas, There was scarcely a large provincial town that had not adopted it. When first introduced, the plant was not so perfect as it was to-day; and although there were some doubts expressed at first as to the safety of using it, there were absolutely none to-day. The Committee proposed to put down plant of the very best kind; and if not English, it was some satisfaction to know it would be British, as it would be supplied by a Canadian firm. The water gas would be sent out to consumers mixed with coal gas in the proportion of one part of the former to three parts of the latter; this being the limit which had been named by a Parliamentary Committee on the subject. Having summarized the advantages of water gas, he said it was a cheaper gas to produce; and last but not least, it would enable them to combat the difficulty they had in purchasing coal. They had had to pay two advances of 6d. a ton; and this year a further advance of 1s. 6d., which meant £12,000 extra this year on their coal bill.

Mr. Edwards seconded the motion, which was adopted.

DEVONPORT GAS COMPANY.

The Annual General Meeting of this Company was held last Thursday, at the Offices, Keyham—Mr. R. C. Smith in the chair.

The report of the Directors stated that the activity prevailing during the past year at the Dockyard and other Government establishments had been reflected in the trade and business relations of the borough generally. The returns of the sales of gas showed that the increment of the past year had been at the rate of 10 per cent.; being about treble the general average. The total amount of gas and meter rents was £27,255, compared with £24,480 in the year 1897-8. The residual market had been very fluctuating, but the aggregate returns showed considerable improvement, especially in the receipts for coke and sulphate of ammonia; the gross revenue from residuals being £8010, compared with £6276 before. The total revenue of the year was £35,271, against £30,768. The rapid advance in the price of coal, iron, and other materials would seriously affect the balances in the current year; as the contracts for supplies had had to be renewed at considerably advanced rates. The total expenditure for coals carbonized, stokers' and other gas workers' wages, renewals and repairs, rates, taxes, and incidental expenses, was £29,512; leaving a balance of £5759 to be carried to the net revenue account. The credit balance was £10,925, out of which the Directors recommended the payment of the statutory dividend of 10 per cent. on the original and 6 per cent. on the guaranteed shares. The renewal and reconstruction of the retort-houses on the regenerative principle was still progressing, and had the unremitting attention of the Engineer (Mr. R. Clark). The number of new services laid during the year had been 540, including those connected with the automatic meters; the gas registered by the latter being 2 million cubic feet.

The Chairman, in moving the adoption of the report and accounts, congratulated the shareholders upon the satisfactory character of the statement. This was partly due to the fact that last year's contracts were placed before the advance in the prices of coal and iron, and partly to the very large growth in population, which, among other things, had led to an increase in the demand for gas. There was no better indication of the prosperity of a town than the station meter of a gas-works. When a town was thriving, the consumption of gas went up by leaps and bounds; and this was the position in Devonport. In order to meet the augmented demand, the Directors had extended the mains to the northern part of the borough, and had replaced some of the old ones by others of larger diameter. They had also adopted the prepayment-meter system, which was especially adapted to the needs of the working classes, for whose accommodation many new houses were being built. They had had a large increase in the consumption of gas, and might expect a still greater demand in the future. The extension of mains and other works entailed expense; and it would be some time before the Company had a return for the outlay they were making. But he had no doubt the return would come in time. The cost of coal last year was £2199 in excess of the previous year; and they also spent £505 more for labour, and £499 more on the maintenance of mains and services. On the other hand, they had saved £1298 in the expenditure on wear and tear of works. The Directors had decided to write off £1500, or 3 per cent., on account of the depreciation of plant and works, to meet the cost of new holders, new machinery, and other things which had to be erected from time to time. The total expenditure on working account, including depreciation and interest on debentures, was £29,512. The receipts for gas and meter rents were £27,255—an increase of £2775. From coke the receipts were £5556; being £1586 more than before. This increase was probably due in great measure to the introduction of carburetted water gas in many of the gas-works in the country. The receipts from other residuals showed a rise of only £148. Tar had been in a very depressed state; but what they had lost on this they had gained on sulphate of ammonia, the price of which had advanced 50 per cent. The total receipts were £35,271; leaving a balance of £5759 to be carried to the profit and loss account. Out of this the usual dividends would be declared. Owing to the advance in the prices of coal and iron, they could not expect such a favourable result next year. In conclusion, the Chairman referred to the death of Mr. R. I. Watts, one of the Directors, and remarked that he had lived to see two or more Boards pass away since he first became a Director fifty years ago.

Mr. T. H. Gill seconded the motion, and congratulated the Chairman upon the fact that, in the jubilee year of his connection with the management of the Company, the undertaking had reached, it was clear, its high-water mark.

The report was adopted, and the usual dividends were declared, and the Board thanked for their services.

GAS v. ELECTRICITY FOR LIGHTHOUSE ILLUMINATION.

In the House of Commons, a few days ago, the subject of the best illuminant for lighthouses was once more introduced by Mr. W. Field, the member for St. Patrick's, Dublin, who asked the President of the Board of Trade whether it was not admitted that the light of either oil or coal gas is superior to electric light in a fog. Mr. Ritchie's answer affirmed the inferiority of the latter light under certain meteorological circumstances—just those, in fact, when the value of a lighthouse is put to the most severe test; and, in a letter to "The Times," Mr. W. F. Barrett, of Kingstown, expresses the opinion that this may be taken to indicate that the Elder Brethren of the Trinity House have been impressed by the weight of evidence which has reached them in favour of the older illuminants. He says: "Those of us who have had the opportunity of examining this question from a scientific point of view have long since come to the conclusion that the employment of the electric arc for lighthouse purposes is a serious mistake, and should no longer be continued. In clear weather, other lighthouse illuminants are amply sufficient in power, and the electric light is very apt to mislead the sailor as to his distance from the light; while in hazy or foggy weather, repeated observations, both of mariners and scientific men, have shown the inefficiency of this light, even of the most powerful electric arc, in a lighthouse of the first order. This may be due in part to the fact that rays of high refrangibility, such as are emitted by the arc light, are more largely absorbed by a fog than rays of lower refrangibility, such as are emitted by oil or gas. Another and perhaps more potent cause appears to be in the very condition which gives the arc light its great value for ordinary optical purposes—namely, its concentration in a minute area compared with oil or gas. This would seem to be a positive disadvantage in a lighthouse illuminant in foggy weather." This subject of lighthouse illumination, it will be remembered, was investigated some years ago at the South Foreland, where an elaborate series of experiments were carried out; and since then several returns on the subject have been presented to Parliament. In one of these, dated February, 1893, Mr. Barrett, in a letter, recorded the results of a series of observations he had made from his house at Kingstown across Dublin Bay—a distance of six miles—on the performance of the "giant lens" which had then been introduced by Mr. J. R. Wigham in connection with his system of lighthouse illumination by gas. Mr. Barrett said: "The experiments and observations in which I have taken part in preceding years have convinced me of the unquestionable superiority, in fog-penetrating power, of a large and brightly-illuminated area over an intense point of light or sharply-defined beam such as is furnished by the electric light." Subsequent observation and inquiry have, he says, confirmed the view he then expressed; and recently, when in the Isle of Wight, a similar opinion was expressed to him by competent observers as to the comparative uselessness in foggy weather of the splendid electric light at St. Catherine's Point. This view is amply supported by the evidence of numbers of practical seamen contained in the returns already mentioned. Here, for instance, is the opinion of Captain Threlfall Bragg, R.N.R., the Nautical Assessor of Liverpool, who, referring to the Lizard Lights with respect to which Mr. Field put his question in the House, says: "When I was in command of the steamship *Anterior*, bound round from London to Liverpool, at night, a short distance east of Lizard Point, a fog came on. As we approached the point, we heard the sound of the Lizard fog siren. The two lights on the Lizard are powerful electric lights, which we were anxiously on the look-out for; but we were unable to see them, as they were completely obscured by the fog, while we were well within the sound of the fog siren, and only passing at a safe distance outside the dangers lying off the point." Mr. Barrett expresses the hope that, as several new lighthouses are in course of erection round our coasts, the Lighthouse Authorities will take steps to place therein the illuminant which experience has proved to be of the greatest service to the mariner. For his own part, and speaking as an unofficial and independent observer, he entirely agrees with the opinion of the former distinguished Scientific Adviser to the Trinity House—the late Professor Tyndall—that, so far, the multiform gas-light, with which the name of Mr. Wigham has so long been associated, has not been surpassed as a lighthouse illuminant.

ELECTRIC LIGHTING NOTES.

The Lancaster Town Council have resolved to erect a refuse destructor in proximity to the electric light station, and to borrow £14,700 to carry out the work.

The Wrexham Town Council agreed last Tuesday to seek the sanction of the Local Government Board to the borrowing of a further sum of £20,000 for the establishment of electrical supply works.

The Ilfracombe District Council, acting upon the suggestion of their Consulting Engineer (Mr. W. H. Trentham) have adopted an electric supply scheme. The estimated cost of the initial equipment is £14,700; and application is to be made for power to raise the money.

The desirability of introducing electric light into the town was discussed by the Ormskirk District Council last Tuesday. A scheme was submitted, which it is estimated will cost £10,000; and, with a maximum price of not more than 7d. per unit, it is calculated that the income will reach £2000 per annum. The Council resolved to apply for a Provisional Order.

The foundation stone of the new Corporation electric lighting works was laid at Stockton last Thursday; the principal part in the ceremony being performed by Mrs. Ford, the wife of the Corporation Gas Engineer. For the purpose, Mrs. Ford was presented with a handsome silver trowel. The generating station (which will be capable of supplying 3000 16-candle power lamps) is being erected on a site adjacent to the gas-works. For the scheme the Local Government Board have sanctioned an expenditure of £28,000.

The Chelmsford Electric Light Company seem to feel very acutely the manner in which the Town Council have dealt with them in regard to the purchase of their works. In January last, the Company suggested that the Corporation should pay them cost price for the undertaking; but the latter made a counter offer of £24,000. The Directors have since written a letter to the Corporation in which they say that it would have been better if the Council had simply declined the Company's suggestion, as it was quite obvious the amount named could not be entertained. The Directors are satisfied that, if a valuation had been submitted to an impartial arbitrator, he would have awarded more than the Company proposed. The offer to sell the works has consequently been withdrawn.

At the Municipal Buildings, Taunton, Colonel A. J. Hepper, R.E., one of the Local Government Board Inspectors, recently held an inquiry into an application by the Taunton Corporation for a loan of £10,000 for electric lighting purposes. The Town Clerk (Mr. George H. Kite) informed the Inspector of the reasons for the application; adding that the money was absolutely necessary for new plant and extensions of the mains, owing to the increased demand for the light. During 1897 they had connected the equivalent of 1580 8-candle lamps; and during the first half of the present year, the equivalent of 2270 of these lamps. The balance-sheet for 1898 showed a profit of £750 on the year's working. Allowing for the reduced charges to customers, the past half year showed an increased income of £250, or £300 over that of the corresponding six months of 1898. Evidence in support of the application was given by Alderman Potter, the Chairman of the Electric Lighting Committee, Mr. Harold Couzens, formerly Borough Electrician for Taunton, and Mr. E. B. Thornhill, the present Borough Electrician. The Inspector visited the works at the close of the inquiry.

The people of Reigate have had their final contest over the electric lighting question before Mr. G. W. Wilcocks, of the Local Government Board. His inquiry, on behalf of that body, into the application of the Town Council for sanction to borrow £25,000 for the establishment of the works was held last Thursday week. The Town Clerk (Dr Grece) addressed himself to convincing the Inspector that the conditions now existing in the locality are tempting for the introduction of the electric light; and Mr. James Powell, the Chairman of the Corporation Electric Lighting Committee, showed how sanguine he is as to the success of the installation by stating that he believed application would be made for the whole of the electrical energy before the works are complete. The chief opposition had reference to the site of the generating station; and in respect thereto, the Corporation seem to have been guilty of a little irregularity. The Council paid £750 for the site, which is in a disused sand pit, and is about $\frac{3}{4}$ acre in extent. The Inspector was curious as to why the conveyance was entered into before sanction was obtained to the loan; and he pointed out that the Board are not fond of that kind of thing. The Town Clerk's reply was that the Council had a definite time given them to accept or reject the land. When the opposition came to lay their case before the Inspector, it was shown that the site was contiguous to expensive residential property, and that the vendor was a member of the Town Council (Alderman Pym.) The latter fact was considered of importance in determining the price paid for the site. The owners of the adjoining residences purchased their ground from Alderman Pym; and although he tied them down by the most stringent covenants as to the user of their property, he is now bringing this nuisance to their very doors. The opponents certainly appear to have made out a good case for a change of site.

The Hampstead Vestry have just issued their electric lighting report for the year ending the 25th of March last. The Clerk (Mr. Arthur P. Johnson) writes in a jubilant tone throughout, and refers to his "pleasant duty" and "the continued growth and prosperity" of the undertaking. The gross amount of loan debt is £126,570—an increase of no less than £67,160 on the preceding year. Although this "appears abnormal," it is explained away by the statement that the greater part of the increase was for expenditure up to the end of the preceding year. The London County Council's requirements "cause considerable difficulty and delay" in the granting of loans—a fact which does not deter the Committee from pointing out that the Vestry will have to apply for a further loan "for the major portion of the expenditure for the past year." Of the £126,570 already borrowed, the sum of £3443 has been repaid. On machinery, the Vestry paid £11,130 during the year—making upwards of £31,000 spent on this item alone since the inauguration; and the cost of laying new mains for the year was £6866, "which indicates that the Vestry are continuing the policy of laying down mains in streets that are likely to furnish customers—a course justified by experience." Out of a possible 300 streets, 155 have been cabled. For "meters and instruments," £4090 was expended during the year—more than double the amount of the previous year, owing to the adoption of Wright's patent demand indicator, with which every consumer is now supplied. The gross profit is claimed to be £13,014 17s. 8d., against £8081 and £5257 in the two preceding years. The Vestry Clerk adds: "In considering this income from public lighting (£2353), it is perhaps advisable to point out that a liberal discount (£430) is allowed, so that the net income is £1923, which charge to the Vestry includes renewals of carbons and all repairs to posts, lamps, &c. The profit on the public lighting is therefore much less than is popularly supposed; but I would submit to the Committee that, with a view to holding the Vestry free from all reproach in the matter, it would be, perhaps, advisable for them to substitute a charge that would be sufficient to cover the actual cost of the light, and maintenance and renewals of the lamps only." The actual cost of the public electric lighting compared with that of the deposed gas-lamps is not included in the report. Another point with regard to gas lighting is revealed in the fact that the office (Vestry Hall) charges in connection with both electric and gas lighting are taken at the same figure; but, as the Vestry Clerk himself remarks, "the amount of time expended on the latter is in no way comparable with the former." He therefore suggests that the Committee should reconsider this item in future. The net profit is calculated at £8339 15s. 6d.; being 6·65 per cent. on the capital, which is considered "an eminently satisfactory return." Had the Vestry been a private trading company, the Vestry Clerk argues that "the dividend would be 9 5 per cent.—a lucrative undertaking." Mr. Johnson makes a very pertinent suggestion when he says: "The Committee should consider the question for contributing the year's profits as an instalment towards the formation of a reserve fund, to meet any exceptional demand on the undertaking in future years. The maximum of the reserve fund is 10 per cent. of the capital; and, accordingly, the capital standing at £125,410, the amount so placed aside should be £12,541. The accumulated profits up to the 25th of March were £11,160, out of which, if the Vestry decide to adopt my suggestion

of transferring the £873, before referred to, from the revenue profits to capital, that amount would be defrayed; reducing the profit to £10,287. In order, however, to have a balance on the right side at the bankers, it would be advisable to retain £2000 or £3000 of this on current account, which leaves (say) £7500 available for reserve, which I would suggest should be invested in some approved Government stock." For the first time on record, the Committee have a cash balance at the bank.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Writing in the shadow of the meeting of the North British Association of Gas Managers, at which I was present at Stirling this week, I have no feeling except that of unbounded gratification. Perhaps this arises partly on the principle that he who expects little shall not be disappointed; for I confess that a programme of three items, one a paper for discussion, another an illustrated lecture, and the third an exhibition, did not impress me as likely to lead to the drawing forth of much of the latent intelligence of the members. The Secretary (Mr. R. S. Carlow) was of a different opinion. He considered that, although he had not been able to get contributions from members, as to which he felt a little hurt, he had made very good arrangements, and that the meeting would be a good one. He was right; and my anticipation was, agreeably to myself, not realized. The attendance was large. I heard Mr. MacPherson, of Kirkcaldy, say that the largest meeting the Association ever held was the centenary (of gas lighting) one held in Stirling in the year 1892, at which Mr. MacPherson himself was President, and that this year's meeting was the next largest. There were nearly 100 members present, which is a good representation of 245, scattered up and down the whole area of Scotland. There are 243 gas undertakings in Scotland; and the membership of the Association is now 245. This looks quite healthy; but it is to be remembered that there are extraordinary members on the list, who are not gas managers. In fact, of managers, there are only 150 in the Association; leaving 95, or more (because Glasgow provides four, and Edinburgh and Leith three members, although there are but two undertakings), who do not participate in the benefits of membership. There is thus room for expansion. There is, I confess, a feature of recent years' meetings which is somewhat disappointing—that is, the absence of the leading members of the profession. I recognize that there are two sides to this question, and that it may be that they, knowing that they have little to learn, stay away so as to give the smaller men a chance—a feeling which must be respected. But then there is the other side, that the smaller men, and the younger members, might learn from them; the Association might be a sort of College for such. This could be accomplished in either of two ways. Either those who would benefit might come forward with papers, and submit them for criticism by their seniors, knowing that the picking of holes in a paper, by wiser men, is one of the best means of learning how not to go wrong again, and would thus be valuable to them; or, if there should be a feeling on the part of the senior members that they do not care to be criticized by those below them, they might contribute an address or lecture, which would not be criticized. Now that a beginning has been made with the lecture method of conducting the business of the meeting, the latter arrangement could easily be made; but both suggestions could be carried out together, and both would be best. What about a lecture by Dr. Stevenson Macadam, one of the honorary members, at Edinburgh next year? The address by his son, Professor W. Ivison Macadam, this year, was undoubtedly better spent time than would have been the reading of a paper and a discussion upon it; because a gentleman in his position can throw an amount of authority into his observations which a working gas manager cannot. There is, however, room for both—a lecture upon a technical subject and papers upon practical subjects. I presume there are not a few gas managers in Scotland who have not yet had the opportunity of seeing carburetted water-gas plant at work; and if there were any such present on Thursday, they now know nearly as much of what the process is like, and they also know the why and the wherefore of many things in the process which they did not before understand, as if they had seen the process at work.

Mr. George Keith's exhibition of the air and gas compressor invented by his father (Mr. James Keith, of London), and which, by the way, was given in the presence of his grandfather, ex-Provost Keith, of Arbroath, was the happiest arrangement which Mr. Carlow made. The exhibition followed Professor Macadam's lecture, which was necessarily given in a darkened room, and the windows being still obscured, the members had the very best opportunity of seeing the effect of the light. Six burners were used; and the brilliancy of the light was so great that, after a time, Mr. Myers, of Saltcoats, asked that daylight should be let in, as the light was too much for his eyes. The meeting was taken by surprise when the compressor was turned on. That the invention is a practical one, and will be useful for more purposes than illumination, is testified by the fact, within my own knowledge, that inquiries are already being made regarding the application of the apparatus to the filling of gasholders at a distance from the works. If it should prove satisfactory in such work, the machine will be a great boon to managers of small works, where they cannot afford an exhauster, as it will, acting as an exhauster, enable the pressure to be kept up; and the cost will be small. There remains to be noticed Mr. Yuill's paper. Mr. Yuill himself did not hold it up as a profound production. It was prepared by him at the last moment, in a hurry, as it were, to save the situation. It was full of information; and if it be said that the information was almost entirely compiled from official returns, the fact is that nobody else had put himself to the trouble to make the compilation, and the paper, concentrating as it did, and focussing information gathered from a wide area, was a valuable as well as an interesting one. It was the platform which shone at the meeting; the floor contributed little to the proceedings, either of interest or in bulk. Only two of the remarks are worthy of notice. The first was by Mr. Myers, of Saltcoats, upon the subject of the layering of gas in gasholders. Professor Macadam replied that gases, when once they were thoroughly mixed, and they were bound almost to thoroughly mix, would never again separate. Although I have said that he spoke with authority, that is a statement which seems open to question. In the first place it was only given as a theory, because the subject has never been tested. In the second place, the theory is opposed to the law of gravitation, and to experience otherwise. The atmosphere is but a gas; and we know that the law of gravitation operates upon it, and that hydrogen rises in it, and carbonic acid falls. The other remark was by Mr. Bell, of Dalkeith, with reference to the poisonous nature of carburetted water gas. The subject is one upon which people appear to make up their minds beforehand, and then to find reasons for their opinions. One thing seems never to be taken account of, which is that a person who suffers from gas poisoning does not breathe pure gas, but a dilution of gas and air. It is not, therefore, the percentage of carbonic oxide in the gas which represents the strength of the poison, but the percentage of carbonic oxide in the air which is breathed. It requires a certain bulk of carbonic oxide to kill a man. Now, if two gases be allowed to escape into apartments of equal size, the one gas containing, bulk for bulk, double the carbonic oxide which the other does, it stands to reason that a person in the apartment where that gas is, will first receive the quantity which will be sufficient to kill him. There is another fact which also seems to be often forgotten—*i.e.*, that when a person is overcome by coal gas, if he be still breathing, he usually recovers; but when once a certain stage in carbonic oxide poisoning is reached, although he may not be even unconscious, no known cure will save his life.

Mr. Pooley made an admirable President He gave a very good address, upon topics such as are likely to come in the way of a gas manager in a town like Dunfermline. In the absence of discussions upon papers, there was not much to control; but, had there been, his policy—a praiseworthy one in a Chairman—of not obtruding himself too much, would have carried the business through with promptitude. As it was, the business was over by three o'clock, and there was a wait of two hours for dinner. I have seen it nearly half-past five before the business could be completed. The earlier hour was appreciated.

The Stirling Gaslight Company provided an excellent luncheon in the Station Hotel, and were otherwise very kind to the Association, throwing open their works, newly renovated, for inspection, and mixing among the members. A return compliment, though not intended as such, was paid in the elevation of Mr. Peter Watson, lately Manager for the Company, to the position of an honorary member of the Association. Mr. Watson is still hale and hearty, and was able to attend this year's meeting of the Association.

The North British Association was not the only body interested in gas supply which met in Stirling this week. The Stirling Gaslight Company held their annual meeting on Tuesday. At it the Directors reported that during the year the works have been completed and brought into operation, at a cost of £8135, of which £5000 falls to be met out of revenue, in terms of their Act. The works are now of the most modern and efficient construction. The costs of promoting the Act, amounting to £4379, have also been paid. To meet these and other capital charges, the Directors have borrowed £10,000 on mortgage, at 3 per cent. interest. There is a sum of £1292 at the credit of capital account, to meet further capital expenditure. The balance at the credit of the revenue account for the year amounted to £3769. Of the £5000 debited to revenue for renewing works and plant, £3000 has been charged against the balance—leaving £2000 to be afterwards dealt with. There was an increase during the year of 7 million cubic feet of gas made; resulting in a considerable increase in revenue, notwithstanding the discounts to large consumers (£163) which now affect the revenue for the first time. The balance of net profit, amounting, with the balance brought forward from the previous year, to £2924, admitted of the payment of dividend at the rate of 7s. per share—equivalent to from 6 to 8 per cent., according to the value of the share—the same as last year; and a balance of £319 being carried forward. The Directors regretted that the revenue of the current year will be prejudicially affected by the increased price of coal; but they do not anticipate that it will be necessary to raise the price of gas. As a result of the recent gas exhibition, there has been a gratifying increase in the use of cooking stoves. There is also an increasing demand for prepayment meters, chiefly among those who were not previously consumers. The sales of gas amounted to 60,845,125 cubic feet, and yielded £10,461 of revenue. Meter-rents yielded £315. There was derived from coke, £480; from tar and liquor, £665; from spent lime, £14. On the expenditure side, the manufacture of gas cost £6558, of which £4479 was for coal, and £185 for lime. The distribution of gas cost £671, and management, £355; but this included an allowance of £110 to the retiring Treasurer. There is a reserve fund of £1500. The share capital amounts to £40,006, and the loan capital to £10,000. This was the first complete year of the Company's working since they were incorporated by Act of Parliament. The result is in every way satisfactory, and should make the party in the Town Council who frustrated the transfer look with dismay upon their policy. The proposal for a transfer was not of the Company's making; but they were willing to acquiesce. The failure of the proposals for transfer was, therefore, rather gratifying to them than otherwise, more especially as they have been able to strengthen their position by Act of Parliament. Since Mr. J. D. Smith became their Manager, now two years ago, the works have been all but renewed, according to plans prepared by Mr. Smith, and under his supervision. They are now in excellent condition, and of model construction. In this work, and in the general management of the Company's business, Mr. Smith has distinguished himself. The Directors and shareholders must feel that their interests are safe in his hands. That they do so is manifest; for they have voted him an honorarium of £150 for his services since he entered upon his duties, and have increased his salary by £50 a year. Both have been well earned, and are thoroughly deserved. No gas company in Scotland has passed through such an ordeal as did the Stirling Company a year or two ago; and it is doubtful if any could have shown such wonderful recuperative power. But, of course, good management goes a long way; and where it is found to exist, as here, it should be acknowledged.

Another instance of advance of salary to a Gas Engineer and Manager, and this, too, as thoroughly deserved as any could be, is furnished in the case of Mr. W. R. Herring, of Edinburgh. The Commissioners on Monday advanced his yearly salary from £900 to £1200, with the right, at the end of the lease, if not earlier, to occupy Granton House and grounds free of rates and taxes. This, I learn, places Mr. Herring in the premier position among the Gas Managers in Scotland. His career since he first of all came to Scotland has been an unbroken and

transcendent success. Everyone admits so; and there could be no better testimony to the fact that it is so than in the circumstance that he carried the proposal for a transfer of the works to a new site without a dissentient voice in the Commission, and that this increase of salary was also voted without a single note of dissent. When he enters upon possession of his new residence, he will be the best housed gas manager, probably, in the United Kingdom. Granton House is a mansion. It is at present tenanted by Mr. Reginald Macleod, the Queen's Remembrancer for Scotland—that is, the head of the Exchequer Department—and brother-in-law to the Duke of Buccleuch. The situation of the house, too, is charming, overlooking the Firth of Forth, much as the Earl of Rosebery's residence at Dalmeny, a few miles higher up the Firth, does. I am much mistaken if Mr. Herring does not, by his own talents, and with the assistance of nature, make the Granton Works the Mecca of gas managers.

The Edinburgh and Leith Commissioners have carried forward a balance of £20,736 of surplus, in preference to adding a portion of it to sinking fund for redemption of annuities. The policy is a wise one; for although there is much to recommend the reduction of the annuity account, this is not the time for laying extra burdens upon their own back. Besides, the money, if set aside in sinking fund, would have been beyond their control except for one purpose; whereas, as they keep it, it will be available for use, and will thus form a working balance, and save them from requiring heavy overdrafts at a high rate of interest from the bank. Besides, again, they cannot compulsorily redeem annuities till the year 1908; and they are at present redeeming as many as come into the market. It was, for instance, reported to the Commissioners this week that a redemption had been effected of £172 12s. 7d. of annuities, at a cost of £5064 14s. 8d. That is, at the rate of nearly 30 years' purchase. The rate prescribed in the Act is 28½ years' purchase. The fund for redemption of annuities now stands at £72,381.

The Gas and Electric Lighting Committee of Aberdeen Town Council had before them on Wednesday the report by their Engineer and Manager (Mr. A. Smith) upon the application by workmen in the gas-works for increase of wages. The report was to the effect that workmen in similar positions in Glasgow and Dundee were in receipt of higher pay; and the Committee agreed to recommend the Council to grant increases, amounting, in the aggregate, to £466 a year.

The annual general meeting of the shareholders of the Carluke Gas Company, Limited, was held on Thursday. From the reports submitted, it was shown that the gas sold during the past year, ending April 30, amounted to 9,705,100 cubic feet—an increase over the preceding year of 2,119,700. The revenue from all sources amounts to £1872, being an increase of £410, and the profits were £524. It was agreed to pay a dividend of 5 per cent. on the capital stock of the Company; and to carry forward a balance of £274. The price of gas was increased by 5d., making the present price 3s. 9d. per 1000 cubic feet. It was reported that the new works were now completed, and capable of supplying all the demands.

"Is a gasholder a building?" This was the question which Dean Sloss had to decide a fewd ays ago at the Dean of Guild Court, Stranraer. The circumstances under which the question arose were these: The Clerk submitted plans of a holder proposed to be erected by the Stranraer Gas Company on a vacant piece of ground in Market Street, adjoining the present holder. The Dean said he had looked up the Police Act, and he could not see a single clause in the Act, or the summary, under which the Court could grant authority for the erection of a gasholder. His whole object in pointing this out was to guard the Court against granting authority which they had not power to do. He did not think a gasholder was a building within the meaning of the Act. Mr. Young, who was of the same opinion, said if it was not a building within the meaning of the Act, it was outside their jurisdiction. Mr. Belford said if they thought it outside their jurisdiction, they were stultifying the powers of the Court. The Clerk said he considered a gasholder was a building. The Dean remarked that it was a very nice question. As he read the Act, there was nothing to give the Court authority. It was agreed to approve of the plan, and sanction the erection of the gasholder so far as the Court might legally do so.

The annual meeting of the Airdrie and Coatbridge Water Company was held on Tuesday. The report and accounts for the past year were submitted and approved of. The report showed that, owing to the increasing prosperity of the district, the Directors had resolved to reduce the domestic water rate from 1s. 4d. to 1s 2d. per pound, as also a corresponding reduction in the rates for supply by meter. The maximum dividends were declared—namely, 10 per cent. on the original ordinary £5 shares, 5 per cent. on the ordinary £10 shares of 1892, 6 per cent. on the 5 per cent. preference, and 5 per cent. on the 5 per cent. preference shares—all subject to deduction of income tax.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 29.

Sulphate of Ammonia.—During the week, there has not been any material change in the market, which has, on the whole, been of a quiet character. Orders, on the one hand, have been rather scarce; but, on the other, few makers have shown any disposition to force sales. The limited business done has, however, been at somewhat irregular prices; the nearest values f.o b. at the ports being to-day £12 to £12 3s. 9d. per ton for prompt delivery. It is evident that buyers have requirements to fill in the near future, but that they are waiting till the last possible moment before making their purchases. Meantime, however, this does not greatly inconvenience makers, who have no stocks; and only a limited production to deal with. For forward delivery, quotations are unchanged but nominal.

Nitrate of Soda is steady at 7s. 7½d. per cwt. for fine quality on spot.

LONDON, *July* 29.

Tar Products.—There is a somewhat better inquiry for benzol; and both 90's and 50's are quoted higher. The other light hydrocarbons are also realizing improved prices. There is no change in the value of other products, some of which show a tendency rather to weakness.

The values obtaining during the week are: Tar, 16s. to 25s. 6d. Pitch, east coast 31s., west coast 28s. 6d. Benzol, 90's 8d., 50's 9d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Heavy naphtha, 1s. 0½d. Crude, 30 per cent., naphtha, 3½d. Creosote, 3½d. Heavy oils, 65s. Carbolic acid,

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 292.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin	10 p. c.	21¼—22¼	..	4 13 4
100,000	10	,,	7½	Do.	7 p. c.	15½—16½	..	4 10 11
800,000	100	July 3	5	Australian	5 p. c. Deb. .	102—104	..	4 16 2
200,000	5	May 12	6	Bombay, Ltd.	. . .	6¼—6¾	..	4 8 11
40,000	5	,,	6	Do.	New, £4 paid .	4¼—4¾	..	5 1 1
880,000	Stk.	Feb. 24	12	Brentford Consolidated		275—280	..	4 5 9
470,000	,,	,,	9	Do.	New . . .	215—220	..	4 1 10
50,000	,,	,,	5	Do.	5 p. c. Pref. .	140—145	..	3 9 0
159,375	,,	June 15	4	Do.	4 p. c. Deb. . .	126—130	..	3 1 7
220,000	Stk.	Mar. 29	11½	Brighton & Hove Orig.	.	260—270	..	4 5 2
226,320	,,	,,	8½	Do.	A. Ord. Stk. .	194—197	..	4 6 4
973,500	Stk.	Feb. 24	5	Bristol,	5 p. c. max. .	125—130	..	3 16 11
420,000	20	Mar. 29	12	British	. . . .	45—47	..	4 5 1
50,000	10	Feb. 24	12	Bromley, Ord.	10 p. c. .	25—27	..	4 8 11
75,000	10	,,	9	Do.	7 p. c. . .	20—22	..	4 1 10
600,000	10	Apl. 27	6	Buenos Ayres (New)	Ltd.	10—10½	..	5 14 3
220,000	Stk.	June 29	4	Do.	4 p. c. Deb. .	100—102	..	3 18 5
150,000	20	July 13	8½	Cagliari, Ltd.	. . . .	28—29*	..	5 13 10
100,000	10	June 1	7½	Cape Town & Dis.,	Ltd.	13—14	..	5 7 2
50,000	50	May 2	6	Do.	6 p.c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Apl. 13	13½	Commercial Old Stock	.	316—321	..	4 4 1
200,750	,,	,,	10½	Do.	New do. .	245—250	..	4 4 0
200,750	,,	June 15	4½	Do.	4½ p. c. Deb. .	143—148	..	3 0 10
600,000	Stk.	June 15	10	Continental Union,	Ltd.	187—192	..	5 4 2
200,000	,,	,,	7	Do.	7 p. c. Pref. .	182—187	..	3 14 10
51,600	Stk	Feb. 24	14	Croydon A	10 p. c. . .	—	—	—
168,400	,,	,,	11	Do.	B 7 p. c. . .	—	—	—
555,000	Stk.	Feb. 24	5½	Crystal Palace Ord.	5 p. c.	135—140	..	3 15 0
60,000	,,	,,	5	Do.	5 p. c. Pref. .	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	. . . .	22½—23¾*	..	4 13 7
354,060	10	,,	11	Do.	£7 10s. paid .	16—17*	—¾	4 17 1
14,993,075	Stk.	Feb. 10	4 p. c.	Gas-light and Coke	4 p. c. Ord. . .	105—108	—¼	4 10 9
2,800,000	,,	,,	3½		3½ p. c. max. . .	96—100	..	3 10 0
3,799,735	,,	,,	4		4 p. c. Con. Pref.	126—128	..	3 2 6
3,993,975	,,	June 15	3		3 p. c. Con. Deb.	99—101	..	2 19 5
70,000	10	May 31	8	Hongkong & China,	Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	May 12	10	Imperial Continental	.	225—230	..	4 6 11
473,600	Stk.	Feb. 10	8½	Do.	8½ p. c. Deb. Red.	102—105	..	3 6 8
75,000	5	June 15	6	Malta & Medn.,	Ltd. .	5—5½	..	5 9 1
560,000	100	Apl. 4	5	Met. of	5 p. c. Deb.	112—114	..	4 7 9
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	110—112	..	4 0 4
541,920	20	May 31	5	Monte Video, Ltd.	. .	13—14	..	7 2 11
617,946	Stk.	Feb. 24	9½	Newc'tle & Gatesh'd Con.		228—233	..	3 19 5
264,855	Stk.	June 29	3½	Do.	3½ p. c. Deb. .	106—109	..	3 4 3
						* Ex div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	May 31	8	Oriental, Ltd.	. . .	7½—8	..	5 0 0
135,000	5	,,	8	Do.	New, £4 10s. pd.	6½—7	..	5 14 3
15,000	5	,,	8	Do.	do. 1879, £1 pd.	1¼—1¾	..	4 11 5
60,000	5	Mar. 29	7	Ottoman, Ltd.	. . .	5½—6	..	5 16 8
500,000	100	June 1	6	People's Gas of Chicago	2nd Mtg. Bonds .	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	. . .	11½—12	..	5 16 8
250,000	Stk.	June 29	4	Do.	4 p. c. Deb. .	100—102	—1	3 18 5
250,000	10	Mar. 29	10	San Paulo, Ltd.	. . .	17—18	..	5 11 1
135,000	Stk.	Mar. 29	10	Sheffield A.	. . . .	244—249	..	4 0 4
209,053	,,	,,	10	Do.	B.	244—249	..	4 0 4
447,427	,,	,,	10	Do.	C.	244—249	..	4 0 4
5,600,000	Stk.	Feb. 10	5½	South Metrop.,	4 p.c. Ord.	140—143	+4	3 14 7
1,460,000	,,	July 13	3	Do.	3 p. c. Deb. . .	100—102*	..	2 18 10
120,000	Stk.	—	6	Tottenham and Edmonton	A. 5 p.c. B. 2½ p.c. 4 p.c. Deb. .	143—145	..	4 2 9
250,520	,,	—	4½			103—105	..	4 5 9
55,100	,,	—	4			115—120	..	3 6 8
182,380	10	June 15	5	Tuscan, Ltd.	. . . .	9—10	..	5 0 0
149,900	10	July 8	5	Do.	5 p.c. Deb. Red.	98—100	..	5 0 0
				WATER COMPANIES.			
746,184	Stk.	June 29	11	Chelsea, Ord.	. . . .	315—320	..	3 8 9
150,000	,,	,,	5	Do.	5 p.c. Pref. .	167—170	..	2 18 10
160,000	,,	,,	4½	Do.	4½ p. c. Pref. 75	148—153	..	2 18 10
175,785	,,	Mar. 29	4½	Do.	4½ p. c. Deb. .	155—160	..	2 16 3
1,730,560	Stk.	Apl. 13	7	East London, Ord.	. .	214—219	..	3 3 11
654,740	,,	June 29	4½	Do.	4½ p. c. Deb. .	155—158	..	2 17 0
390,000	,,	,,	3	Do.	3 p. c. Deb. .	101—103	..	2 18 3
700,000	50	June 15	7½	Grand Junction	10 p. c. max. . 4 p. c. Deb. .	111—114	..	3 5 9
310,000	Stk.	Mar. 29	4			135—140	..	2 17 2
708,000	Stk.	Feb. 10	14	Kent	. . . . .	360—365	..	3 16 9
160,000	,,	,,	7	Do. New,	7 p. c. max. .	210—215	..	3 5 1
1,043,800	100	June 29	10½	Lambeth,	10 p. c. max. .	298—303	..	3 9 4
406,200	100	,,	8	Do.	7½ p. c. max. .	225—230	..	3 9 7
350,000	Stk.	Mar. 29	4	Do.	4 p. c. Deb. .	135—140	..	2 17 2
500,000	100	Feb. 11	13½	New River, New Shares		430—435	..	3 3 3
1,000,000	Stk.	July 28	4	Do.	4 p. c. Deb. .	135—140*	..	2 17 2
902,300	Stk.	June 15	7½	South-wark and Vauxhall	Ord. . . . 7½ p. c. max. . 5 p. c. Pref. 4 p. c. A Deb.	203—208	—1	3 12 1
126,500	100	,,	7½			193—198	..	3 15 9
489,200	Stk.	,,	5			167—172	..	2 18 2
1,019,585	,,	Apl. 13	4			135—140	..	2 17 2
1,155,066	Stk.	June 15	10	West Middlesex	. . .	295—305	..	3 5 7
200,000	,,	,,	4½	Do.	4½ p. c. Deb. .	154—158	..	2 17 0
200,000	,,	Mar. 10	8	Do.	8 p. c. Deb. .	102—104	..	2 17 8
						* Ex. div.		

60's 2s. 1d., 75's 2s. 7½d. Creosote salts, 50s. Anthracene, "A" 3¾d., "B" 2¾d.

Sulphate of Ammonia continues a quiet market, although the end of the week is marked by a little more inquiry. £12 to £12 2s. 6d., less 3½ per cent., is about the value at all ports. Buyers are offering nearly the same price for early forward delivery.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—An active demand is reported for all descriptions of fuel suitable for iron-making, steam, and general manufacturing purposes, with supplies of anything short to meet requirements, and prices strong at full list rates; the tendency being decidedly in a hardening direction. Common round coals, for steam and forge purposes, are readily fetching 8s. 9d. to 9s. per ton at the pit mouth. The shipping trade in steam coal is also increasingly brisk, and prices are firm, although without quotable change; ordinary qualities, delivered Garston Docks, averaging 9s. 6d. to 9s. 9d. per ton, High-Level, Liverpool, 10s. to 10s. 3d., and Partington tips, Manchester Ship Canal, 10s. 3d. The reduced quantity of round coal now being screened for house fire consumption necessarily still further diminishes the supplies of slack, which are inadequate to satisfy the present pressing demand, and collieries are stiffening in their prices. Current quotations remain at about 4s. 9d. to 5s. for common slack, 5s. 6d. to 5s. 9d. for medium, and 6s. 6d. to 6s. 9d. for best sorts at the pit mouth; but forward contracts are only being taken at an advance of 3d. per ton over present rates. Coke maintains an exceedingly strong position; supplies being scarce, with prices firm at the recent advance—ordinary furnace cokes fetching 18s. to 19s., and foundry qualities 26s. to 27s. at the pit mouth. With regard to house fire coal, inquiry is very limited; and even the restricted summer requirements are being further considerably curtailed by the very large and rapidly increasing adoption of gas appliances for cooking and other purposes. With collieries working four to five days, stocks are accumulating. But these still stand at an abnormally low level for the time of the year; and there is no attempt to push sales. Prices are firm at 11s. 6d. to 12s. 6d. best Wigan Arley, 10s. to 11s. Pemberton four feet and seconds Arley, and 9s. to 9s. 6d. for common house coal at the pit.

Northern Coal Trade.—The coal trade has developed increased activity; and with a large arrival of steamers for cargo, there has been a pressing demand for coal, especially for steam and bunker sorts. Prices have risen for best Northumbrian steam coals to as high as 13s. per ton f.o.b.; for second class steam coals to 12s. per ton; and to 6s. per ton for steam smalls, and at that price even cargoes are not plentiful. For bunker coals there has been a very full demand, and the price is now 10s. per ton f.o.b.; while for screened bunker coals much higher prices are asked. Household coals are very steady for the season; but the demand is not very heavy. Manufacturing coals are in brisk request; and there is a firmness in prices, as the supplies are only adequate. The gas coal trade is very steady, and gas coals are rather scarce; some local holidays having interfered with the output of some of the largest of the collieries. The demand is now beginning to increase; and there is a possibility of a scarcity of gas coal in a month or two. Prices of gas coals are firm; the basis being from 9s. 6d. to 10s. per ton f.o.b. The coke trade is brisk, and prices are firm. For gas coke the demand is full, and the stocks are limited; the f.o.b. price being 13s. 6d. per ton.

Scotch Coal Trade.—The miners have now returned to work, having taken a longer holiday than usual, owing, it is conjectured, to their having more money to spend. The market is firm. The masters and men this week agreed to the formation of a Conciliation Board, and to the wages not being increased more than 31¼ per cent. over the 1888 basis; an advance of 3d. per day to be given as from Aug. 1. The terms of the arrangement are that the present nominal rate of 6s. 3d. per day will hold good for six months from the 1st of August next; while for the further period of six months, from the 1st of February next, the wages must not come below 5s. 3d. or exceed 7s. This, it is expected, will have a steadying influence on the market; and may lead to the price of coal coming down a little. The prices quoted per ton, f.o.b. Glasgow, are: Main 9s. to 9s. 3d., ell 9s. 6d. to 10s. 3d., and splint 9s. 9d. to 10s. 3d. The shipments for the week amounted to 152,351 tons—a decrease of 31,346 tons upon the previous week, and of 13,500 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,725,968 tons—a decrease upon the corresponding period of last year of 500,417 tons.

Recognition of County Councils as Water Authorities.—Statements were made at the meeting of the Notts. County Council last Tuesday with reference to the passing of the Derwent Water Bills through Parliament. Our readers are well acquainted with all that has transpired in connection with these measures, so that it is unnecessary to enter at length into the reports presented to the Notts County Councillors. The point, however, made by Mr. Tylden Wright may be recorded. It was that on this occasion the right of the Council to appear before both Houses of Parliament with reference to water questions had been conceded for the first time. Lord Belper, the Chairman, supplemented this remark by stating that the position of the county of Nottingham gave rise to some strong opposition on the part of the promoters of the Bill. As Mr. Tylden Wright had observed, for the first time County Councils had had their position clearly recognized in this respect. An amount of water had been set aside at the request of the County Council for possible wants in the future of authorities within their own district. To his mind, it was a most important recognition on the part of Parliament. At the present time, the counties, especially those in the neighbourhood of London, and of the large towns, were in a state of great fear with respect to the future of the water in their districts; and at the last meeting of the County Councils Association a Sub-Committee was formed for the purpose of considering the whole position of counties in regard to this serious question. An important precedent had been set. What they had obtained was not precisely what they had asked for; but they had had a million gallons of water per day allotted to them, and nobody could take it away until 1930.

LATEST DEVELOPMENT
IN
GAS-COOKERS

WRIGHT'S PATENT,
BY WHICH ALL THE
ADVANTAGES OF LOOSE BURNERS
ARE OBTAINED
WITHOUT
ANY OF THE DISADVANTAGES.

NO EXTRA CHARGE IS MADE
FOR THESE IMPROVEMENTS.

JOHN WRIGHT & CO.
LIMITED,
LONDON & BIRMINGHAM

The Brigg Urban District Council and the Gas-Works.—At a recent meeting of the Brigg Urban District Council, the Gas Committee reported having received a claim for £31,370 from the Brigg Gas Company for the compulsory transfer of their undertaking, with an intimation that, unless the Council agreed to pay this sum, the matter would have to be settled by arbitration. The Committee suggested the retention of such expert witnesses as their Engineer advised, and the taking of other necessary steps to protect the interests of the town. This was agreed to.

A Gas Supply Fired by a Colliding Engine.—An engine travelling from the Manors Station, Newcastle, to the goods station west of the Central Station, last Tuesday morning, left the rails near the junction of the North line and the High-Level Bridge, and crashed into the gas-meter house, through which the whole of the North-Eastern Company's gas service on the north of the Tyne is controlled. The end of a connecting-pipe was torn away, and the escaping gas ignited beneath the engine. The meter-house caught fire, although the gas supply was promptly cut off, and the meter and house were both destroyed.

Reduction of Gas and Water Charges at Birkenhead.—The Gas, Water, and Electrical Committee of the Birkenhead Corporation have resolved that, from and after Sept. 30 next, the price of gas to consumers within the borough be reduced from 2s. 10d. to 2s. 8d. per 1000 cubic feet, and that a rebate or allowance of 2d. per 1000 cubic feet be made to such consumers from and out of the fund called the "Reduction of Price Account," making the net price of gas within the borough 2s. 6d. per 1000 cubic feet, instead of 2s. 8d., as at present. The quantity of gas supplied for a penny on the prepayment system is to be increased from 24 to 25 cubic feet. The Committee have also decided that, on and after the same date, the charge for water supplied for domestic purposes be reduced from £5 to £4 15s. per cent. per annum upon the net annual rateable value of a dwelling-house or part of a house.

Incandescent Gas Lighting in the Bedford Square District.—The St. Giles's District Board of Works are again experimenting with incandescent gas-burners for public street lighting. The Board tried these burners a few years ago; but the system was then only in its infancy, and the destruction of the mantles was so great (due mainly to the vibration) that the installation could hardly be considered a success. Since then, however, considerable improvement has been made in the burner generally; and the Board have considered the present a fitting opportunity for giving the light a further trial. The streets selected are Gower Street, Montague Place, and Bedford Square. In Gower Street, two incandescent burners, each consuming 3 cubic feet of gas per hour, without chimneys, and fitted with anti-vibration springs, have been placed in new square lamps; and in the other streets named, one burner, consuming 4 cubic feet of gas, has been fixed in the existing lanterns—these burners being provided with a glass bulb-shaped chimney. It is too early yet to say which of the two systems on trial is best adapted for street lighting; but it is an indisputable fact that the light given is far superior to that of the burners ordinarily used. In Bedford Square, the lamp-columns have been re-arranged and brought closer together; and the square is now one of the best illuminated in the Metropolis.

The Tiverton Gas Undertaking.—The accounts of the Tiverton Corporation gas undertaking show that the revenue last year exceeded the expenditure by £1689, and that, after payment of interest and sinking fund, a balance of £250 remained to be carried to the reserve fund. The capital expenditure to the end of the financial year was £22,870. An increased consumption of gas for cooking, heating, and motive power is reported as the result of reducing the price for these purposes.

The Crediton District Council and the Gas-Works.—An answer has been received by the Crediton District Council to their recent application to the Gas Company to state the terms upon which they would sell their undertaking. The Directors say that they will consider the application upon the District Council agreeing to pay all the costs of a valuation by a competent gas engineer, the choice of whom is to be a matter of agreement between the Company and the Council. When they have received the valuation, the Directors will lay it before the shareholders for their consideration.

Neath Corporation Gas-Works.—The Neath Corporation are to be congratulated upon possessing a successful gas undertaking, as shown by the fact that the gross profit realized for the past financial year was £2899, or £253 more than that for the preceding twelve months. There was an increase of £522 in the gas-rental; and the total receipts were £777 in excess of those for the year 1897-8. This result was achieved in face of a loss of about £300 in consequence of the South Wales coal strike, and an increase of £140 in wages. After paying off instalments of loans and £1340 of the principal, there was a balance of £649 to be carried forward. The satisfactory position of the undertaking is due largely to the skilful management of Mr. R. Browning, the Gas Engineer to the Corporation, who is just now carrying out considerable extensions of the works, which, when these are completed, will be equipped with the latest improvements. With their assistance, he will doubtless be able to show still better results in the future.

The Lighting of Newmarket.—The tenders which the Newmarket Gas and Electric Light Companies submitted to the District Council for public lighting have been under examination by the Lighting Committee. The tenders were noticed in the "JOURNAL" last Tuesday; and at the meeting of the Council that day, the Committee recommended for consideration tender No. 3 of the Gas Company, and tender No. 1 of the Electric Light Company. In the course of the discussion, Mr. Westrope moved that the Electric Light Company be asked to submit a tender for the lighting of Upper Station Road and the High Street, with sixteen 800-candle power arc lamps, and the Gas Company to tender for the lighting of the rest of the district. Mr. Segrott seconded the motion, and expressed approval of the idea that the lighting contract should be divided. Mr. S. Westley read a number of figures, with the object of proving that the Gas Company offered a far larger aggregate candle power than the Electric Lighting Company. Mr. Cattrall and Mr. Carr spoke in support of the motion. The Chairman (Mr. W. B. Sheppard) expressed the opinion that the ratepayers would regard the question simply as one of money; and from this point of view, he thought the Gas Company's scheme was preferable. The motion was carried.

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The New Water-Works of the Newport (Mon.) Corporation.—The members of the Newport Corporation have paid their second annual visit to Wentwood for the purposes of inspecting the famous puddle trench and other works which are being carried out, in order to provide an adequate water supply for Uskside for many years to come. The scheme, which has passed through many vicissitudes, is being executed directly by the Corporation under the supervision of the Water Committee; and already £160,000 has been paid out on account of the works, which will not, it is calculated, be completed for about another two years.

Gas v. Electricity for Street Lighting at Bolton.—A special meeting of the Gas Committee of the Bolton Town Council has been convened to consider a request made by the Electricity Committee to the effect that 50 electric arc lamps be fixed in the central parts of the town. There is a difference of opinion between the principal officials in the two departments as to the cost of installing electricity for street lighting purposes; and there have been reports issued from each dealing with the subject. The last is by the Electrical Engineer (Mr. Arthur Ellis), and in it he says that the most satisfactory method of lighting Bolton streets by electricity would be by the use of rectifiers, because by this system the lighting would be worked on a distinct system of its own, and would not interfere with private lighting. Furthermore, the lamps would be controlled from the power station, and would not necessitate a man going round to light up each lamp as would be the case in other systems. He puts the charge as follows: Lamps placed 80 yards apart, £18 each per annum; 60 yards apart, £16; and 40 yards apart, £15. The cost per mile would be respectively £396, £464, and £616, based upon the assumption that the lamps would be extinguished at midnight.

The New Meter-Testing Station at South Tottenham.—It may be remembered that at the meeting of the Middlesex County Council in March (see "JOURNAL" for March 21, p. 738) reference was made to a proposal submitted by Messrs. T. Glover and Co., of St. John Street, Clerkenwell, who were about to construct a new factory at South Tottenham, within the area of the Council, that they should build and equip a meter-testing station in the locality, the rent to be 5 per cent. on the cost of construction of the building only, and not to exceed £50, the apparatus to become the property of the Council, and the County to be guaranteed from loss. At the meeting of the Council last Thursday, the General Purposes Committee presented a report on the matter, in the course of which they stated that they had had under consideration a draft of the deed which had been forwarded by the Solicitors to Messrs. Glover, embodying some suggested modifications of the conditions previously adopted; and the Committee recommended the Council not to enter into Messrs. Glover's title to the premises proposed to be leased, that the Council should keep the premises in good repair during the term of the lease, that the premium on the insurance of the buildings should be paid by the Council, and that the condition that all meters made by Messrs. Glover in the county should be stamped at the testing-station should not apply to meters specially owned by customers unstamped. These recommendations were adopted without discussion; and it was decided to seal a deed of covenant embodying the terms, and to refer to the County Solicitor to settle the terms of the lease to be granted to the Council.

Reduction in the Price of Gas in the Metropolis.—As will be seen by the report of the South Metropolitan Gas Company which appears in another part of the "JOURNAL," the Directors have decided to reduce the price of gas to ordinary consumers from 2s. 2d. to 2s. 1d. per 1000 cubic feet, to take effect from the meter-taking at Midsummer last. To slot-meter consumers the price will also be reduced 1d.—viz., from 2s. 11d. to 2s. 10d. per 1000 cubic feet. The Commercial Gas Company have notified to the Mile End Vestry that on and after the expiration of the present quarter their charges for street lighting will be reduced from £1 9s. to £1 5s. per lamp per annum. This reduction will mean a saving to the ratepayers of something like £400 per annum.

Huddersfield Corporation Water Supply.—The water undertaking is a very large item in the extensive programme of the Huddersfield Corporation. The expenditure on the construction of the Butterley reservoir to April 30 was £218,643; the amount expended during May was £2888; and during June, £5116—a total of £226,647. On the Blakeley reservoir, £22,886 had been expended to the end of April last; £926 during May; and £1340 during June—a total of £25,152. When the new reservoirs are completed, it is expected that considerable profit will accrue to the town. The census returns for 1891 showed the population to be 75,417; but it is estimated that the total population supplied is 146,325. The dawn of the twentieth century will most probably witness the completion of the whole of the water-works scheme. Half the members of the Town Council, with a few invited guests, recently made a tour of the reservoirs and works.

Athlone Gas-Works Extensions.—Mr. P. C. Cowan, of the Local Government Board for Ireland, held an inquiry last Thursday at Athlone into an application by the Local Authority for a loan of £4500 for the purpose of improving and extending the gas-works. It was shown by the Town Clerk (Mr. P. V. C. Murtagh) that the income from the gas-works had been increasing year by year during the last decade; and this was borne out by the statement of the Gas Manager (Mr. Bradley). He informed the Inspector that two years ago the output of gas was 5,800,000 cubic feet, and now it was 8,128,000 feet, or an increase of slightly over 40 per cent. The demand for gas was such that he anticipated it would be necessary in future to be in a position to supply the town with 100,000 cubic feet per day during the winter season. Witnesses were called to show that they had had occasion to complain of the insufficiency of the gas supply in winter; and one of them stated that, unless he was sure improvements were to be carried out at the gas-works, he intended to light his premises by electricity. Opposition was offered by a number of ratepayers who considered the rates high. Arising out of this inquiry, it is stated that for several years the Military gas-works, maintained by the Government, have been in competition with the works of the Local Authority. Among the latest contracts which have been secured is, it is alleged, the public lighting of the Midland Railway Station and locomotive works. Owing to the Military works being maintained by the Authorities, the price for the gas they supply is 1s. per 1000 cubic feet cheaper than the town gas. Immediate steps, it is reported, are to be taken by the Local Authority to test the legality of a Government department entering into competition with local enterprise.

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TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
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BUFFALO, N.Y.	2,000,000
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AND ADDITIONAL WORK.

Chelmsford Water Supply.—The Town Clerk of Chelmsford has been instructed to apply to the Local Government Board for a loan of £3000 to carry out works immediately required in connection with the water supply.

The Charge for Water at Burton-upon-Trent. — It may be remembered that disputes have arisen between the South Staffordshire Water Company and the consumers in certain districts supplied by them, in regard to their charges. The Burton-upon-Trent Town Council referred the subject to their Estates and General Purposes Committee, who submitted a case to Mr. C. A. Cripps, Q.C., M.P. The Committee reported, at a recent meeting of the Council, that Mr. Cripps was of opinion that the Council would not be justified in taking proceedings to obtain any abatement in the charges in the Staffordshire portion of the borough, to bring it into line with the charges in Stapenhill and Winshill. In the discussion which followed, a general opinion was expressed that a test case should be commenced, and, if necessary, carried to the House of Lords. Ultimately it was decided to have another Counsel's opinion before proceeding further.

Water Supply for Soyland.—Mr. H. Tulloch, recently held an inquiry at Soyland relative to an application made to the Local Government Board by the Soyland District Council for sanction to the borrowing of £12,000 for providing a supply of water for the district. The only opposition was by certain millowners, whose representative (Mr. Freeman) said he wished to be satisfied that the proposed supply was good and adequate, and that it could be provided for the amount estimated. In support of the application, Mr. Bairstow said that in 1897 the Medical Officer of the Council reported that the existing supply, besides being inadequate, was not altogether satisfactory as to its quality. The result was that pressure was brought to bear both by the West Riding County Council and the Local Government Board; and, subject to the approval of the latter body, the District Council decided to purchase Black House Farm as a site for a reservoir. The total present population of the district was 3300, the rateable value was £13,707 10s., and there was no debt. Every care had been taken in gauging the flow of water; and it was found that there would be an average daily supply of more than 100,000 gallons. The minimum supply, even in the driest weather, had proved to be 43,000 gallons. It was proposed to construct a reservoir capable of holding 5½ million gallons, which was equal to 90 days' supply, at the rate of 20 gallons per head of the population daily. Taking even the driest time, the demand on the reservoir would only be 23,000 gallons per day. The provision proposed, therefore, was ample, not only for the present, but for some time to come. With regard to the quality of the water, the District Council had had it analyzed, and it had been declared to be very good for domestic purposes. Mr. Freeman contended that if the scheme was carried out, it would seriously damage valuable properties below the site of the works. Beeston Hall Mill, owned by his clients, was, he said, worth £7000; and any interference with the supply of water for the wheel might result in the works having to be closed. Mr. Bairstow replied to the objections raised, and the Inspector subsequently visited the site of the proposed reservoir.

Re-fixing Water-Pumps under Difficulties.—A partial failure in the supply of water from the Balcombe works on the 16th and 17th ult. formed the subject of a lengthy report from Mr. F. W. Dobson, the Manager, which was presented at the meeting of the District Council on Friday. He recounted, in detail, the operations of taking out, repairing, and re-fixing the 10-inch pumps, and stated that the men worked admirably under the most trying conditions; for the temperature of the well was at the least 120° Fahr. They were in the well between nine and ten hours, and were almost exhausted. Mr. Dobson expects the new set of pumps will be at work within two months, when the plant will, he says, be all that can be desired.

Projected Cumberland Water Scheme.—A preliminary meeting has been held at Wigton, at which an important water scheme was propounded for supplying several localities, including Mealsgate, Aspatria, West Newton, Abbey Town, and Silloth, from Overwater, a small lake at Ireby, in the Cumberland hills; it being understood that some of the tributaries of the River Ellen would also be utilized. The scheme was favourably received by the local representatives; and the interested District Councils will shortly be called to decide upon the matter. In the event of their failure to take it up, it is probable that the scheme will be carried through by private enterprise. The actual distance to be traversed by the main is rather more than 18 miles, and several districts at present inadequately provided with water will be supplied.

Colne Valley Water Company.—The half-yearly general meeting of this Company is to be held at Bushey to-day (Tuesday), when the Directors will report an increased income, in the six months ending June 30, of £1461, as compared with the corresponding period of 1898; while the total expenditure was only £53 more. The profit is £7176; and the total amount available for division, after payment of interest, is £6171. Out of this balance the Directors have considered it advisable to transfer £750 to the old engines suspense account, and so close that account altogether; and they have also transferred £100 to the reserve account—making the latter up to £1505. This leaves a balance of £5321, out of which they propose to pay a dividend of 5½ per cent. per annum, less income-tax; leaving £650 to be carried forward.

The Water Question in South Essex.—The Ilford District Council are about to consider an important report of the Water Committee, the main recommendations of which are as follows: (1) That it is expedient that the supply of water to the districts comprised within the limits of the South Essex Water Bill, 1899, be under the control of a public authority, and for this purpose that a representative Board be constituted and incorporated; and that the undertaking of the South Essex Water-Works Company be acquired by such Board. (2) The Committee recommend the Council to appoint the Chairman and Vice-Chairman to be members of a Joint Executive Committee in course of formation by such of the Councils as are combining to formulate a scheme for the foregoing purpose. No reference is made to the East London Water Company, who have the right to supply a portion of the district. The Authorities of Orsett, Grays, Romford, and Barking are, we believe, already pledged to the undertaking.

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The Watersheds of the Leeds Corporation.—The Leeds Corporation, on the recommendation of the Water Committee, intend purchasing High House Farm, Fewston, with 39 acres of land, for £2800, and other property in the same neighbourhood for £670. This is in furtherance of their policy of obtaining as far as possible complete ownership of the gathering-grounds of the city water supply.

Enormous Consumption of Water at Epsom.—At the meeting of the Epsom Urban District Council last Wednesday, the Water Committee reported that the Council's representative (Mr. Aston) had informed them of his interview with the Board of the Sutton Water Company, and directions were given for application to be made to Mr. W. V. Graham, their Engineer, with a view to ascertaining what his fee would be for making the necessary investigations for checking the quantity of water pumped at the works, and generally as to the best means of preventing waste. The report stated that Mr. King, the Engineer of the Epsom works, was in attendance; and, answering a question, he said he required from Sutton 200,000 gallons a day at this season of the year—making an average of more than 60 gallons per head per day. The Directors of the Sutton Company said they did not feel in a position to supply the Engineer's demands; 40 gallons per head per day being more than they consumed for all purposes in their own district. Considering that Tunbridge Wells was satisfied with about 21 gallons per head per day, and most districts were contented with 30 gallons and less, they did not think they would be justified in risking their own supplies. It was resolved to reduce the street-watering vans at present in use from three to one; the Engineer stating that this would give 20,000 gallons more water per day to the consumers. Mr. Aston said the consumption per day was 550,000 gallons, or 55 gallons per head for a population of 10,000. This consumption was enormously greater than it ought to be; and he believed that if proper measures were taken to detect and stop the waste of water, it might be reduced very largely—possibly one-half, or even more. Mr. King said a great deal of waste took place in the summer months by water being used for gardens. It was decided that, if terms could be arranged Mr. Graham should be retained as Consulting Engineer for one year, to assist in guiding the administration of the water-works.

The Haworth District Council have accepted the tender of Messrs. R. Dempster and Sons, Limited, of Elland, for new annular condensers.

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Apply to the BRIMINGTON CARBON COMPANY, Bowerby Bridge, YORKS.

PRACTICAL RETORT SETTER.

GEORGE NUTTALL, 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

GAS TAR wanted.
BROTHERTON AND Co., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SHEFFIELD CHEMICAL COMPANY, LIMITED.
BUYERS of Spent Oxide. Sellers of OXIDE OF IRON and SULPHURIC ACID.

FIRST-CLASS Gas-Fitter wants Temporary or Permanent Employment.
VICKERS, 47, Sycamore Road, Handsworth, BIRMINGHAM.

WANTED, a Situation as Working MANAGER of a Small Gas-Works, making up to 6 millions. Seven Years' Reference from last place, and Two Years' from present one. Excellent Testimonials. Change desired.
Address No. 3318, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN (age 25), practical, having good experience in Gas Plant and Structural Ironwork, desires SITUATION. Thoroughly acquainted with the routine and construction of Modern Gas-Works, and able to superintend Erections. Good References.
Address No. 3319, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

STOKER wanted immediately for Works in Suffolk. Shovel Charging. Wages 18s., and Cottage, Fire, and Gas. Abstainer preferred.
Apply, by letter, to No. 3314, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Young Man as Stoker, used to Engine and Exhauster, and with a knowledge of Fitting. Abstainer preferred.
Apply, by letter, to No. 3320, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, two good leading Stokers, used to Engine and Exhausters and Regenerative Furnaces. Wages 24s. Permanency for good steady Men.
Apply to the MANAGER, Gas-Works, Maldon, ESSEX.

GAS MAN wanted (single handed) to take charge of small Colliery Plant near Durham. State Wages required and Experience. House and Coal free.
Apply, by letter, to No. 3316, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Two Leading Stokers, accustomed to Regenerative Settings and West's Machine Stoking. For Steady, reliable Men, position permanent.
Apply, by letter, stating Age, References, and Wages expected, to No. 3311, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, by a Gas Company near London, a thoroughly efficient Man with a sound knowledge of DISTRICT INSPECTION, and more especially used to Localizing Leakages.
Apply, stating previous practical Experience, Wages required, and when Services would be available, to No. 3317, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CORPORATION OF MOSSLEY.

GAS MANAGER.

THE Gas Committee of the above Cor- poration require the services of a Competent Man as MANAGER of their Works. Salary £175 per annum, with House, Coal, and Gas free.
Applications, with *copies only* of not more than three recent Testimonials, to be forwarded to the undersigned on or before Monday, Aug. 14, 1899.
JOSEPH HYDE,
Town Clerk.

WORTHING GAS COMPANY.

CHIEF Clerk wanted, age not under 30, Commencing Salary £120, with annual Increments of £10 to £150.
Apply, in writing to the undersigned, with *copies only* of three recent Testimonials, not later than the 10th of August.
No one without a thorough experience of the Statutory Form of keeping Gas Accounts and preparation of Balance-Sheet need apply.
W. F. VERRALL,
Secretary.
July 24, 1899.

NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

DISTRIBUTION SUPERINTENDENT.

THE Directors of the above Company invite applications for the position of DISTRIBUTION SUPERINTENDENT under the Engineer. Candidates must have had a good general and technical Education and Experience in the Distribution Department of a Gas Undertaking. The Salary will commence at £225 per annum.
Applications, endorsed "Distribution Superintendent," stating Age, Experience, present Employment, &c., accompanied by *copies* of not more than three recent Testimonials, to be sent in to the undersigned on or before the 8th day of August, 1899.
(Signed) THOS. WADDOM,
Secretary.
Gas Offices, Newcastle-upon-Tyne,
July 20, 1899.

NORTH OF IRELAND ASSOCIATION of GAS MANAGERS.

THE

ANNUAL MEETING

Of this Association

WILL BE HELD IN THE

CITY HALL, DUBLIN,

ON TUESDAY, AUG. 8, 1899.

The Chair to be taken at 11 a.m. by the President,
Mr. J. W. AUCHTERLONIE, Mullingar.

The Business will consist of an Address by the President, and the Reading and Discussion of the following Papers: "Notes on Building Construction in Small Gas-Works," by Mr. S. B. Langlands, of Coleraine; "On the Working of a Semi-Regenerative Setting," by Mr. W. A. Reid, of Longford; "In Favour of Differential Rates for Gas," by Mr. R. B. Anderson, of Westminster. There will also be a Lecture by Professor C. R. C. Tichborne, LL.D., F.I.C., Gas Examiner to the Board of Trade, Dublin, on "The Continuous Method of Estimating Impurities in Coal Gas."

Permission has been kindly given for the Members to visit the Works of the Alliance and Dublin Consumers' Gas Company; also Messrs. Guinness, Son, and Co.'s Brewery. On the invitation of C. S. Spear, Esq., the Members will dine together in the Gresham Hotel, Sackville Street.

Preliminary arrangements have been made for an Excursion to Bray, the Dargle Glen, and the Powerscourt Demesne, on the day after the Meeting.

A WORKING Manager wants to Lease a small Gas-Works, making from half-a-Million upwards. No matter in what condition. Small Interest will be given.
Address No. 3318, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a small Gas-Works, a second-hand GASHOLDER.
Full Particulars as to Size, Condition, Price, &c., to be sent to the SECRETARY, Sturminster Gas and Coke Company, Limited, Sturminster, Newton, DORSET.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

COUNTY BOROUGH OF WIGAN.

FOR SALE—Two good Second-hand PURIFIERS, and TRAVELLING LIFTING APPARATUS, capacity 20 ft. by 20 ft. by 4 ft. 6 in.
May be seen on application to
J. TIMMINS,
Engineer.
Borough Gas-Works, Wigan,
July 21, 1899.

FOR SALE, cheap—
Two PURIFIERS, 5 ft. square by 4 ft. deep.
One " 5 ft. " 3 ft. "
One EXHAUSTER, 20,000 Cubic Feet per hour.
Two " 5000 " " "
Also CONDENSERS, SCRUBBERS, WASHERS, GASHOLDERS and TANKS, VALVES, &c., &c.
Apply to SAML. WHILE AND SON, 60, Queen Victoria Street, LONDON, E.C.

STATION METER FOR SALE.

OFFERS invited for Station Meter to be removed next October, after the fixing of a new one rendered necessary by the enlargement of Works. Six-inch connections; 5000 cubic feet per hour.
Apply to the undersigned.
D. H. JONES,
Borough Accountant.
Guildhall, Carnarvon.

FOR SALE—Forty Cast-Iron Mouth- PIECES, with Self-Sealing Lids, 18 in. by 15½ in. at back, 18 in. by 13 in. at front; Off-Takes in various positions.
Also One (Waller) TWO-BLADE GAS EXHAUSTER, capable of passing about 30,000 Cubic Feet per hour, with 12-inch Valves, but without Engine.
Price and further Particulars may be had from
J. D. ASHWORTH,
Engineer.
Gas-Works, Portsmouth.

FOR SALE, cheap to clear—
TOWER SCRUBBER (Walker), 5 ft. by 25 ft. high, complete.
STATION METER, 8-inch, complete and perfect.
EXHAUSTER and ENGINE, combined (Waller), 9-inch Valves, Governors, &c., complete.
GASHOLDER, 35 ft. by 14 ft. deep, only Six Years old.
CAST-IRON TANK, 31 ft. dia., 12 ft. deep, nearly new.
Four 10-feet PURIFIERS, Centre-Valve and Connections.
EXHAUSTERS, sizes from 4000 to 30,000 Cubic Feet per hour in stock.
J. FIRTH BLAKELEY & Co., Gas Engineers, Thornhill, DEWSBURY.

FOR SALE—Gas Plant, comprising two Holders (Total Capacity 85,000 Cubic Feet), Scrubbers, Purifiers, Pump, Tar-Tank, Fire-Brick Retorts, &c., &c.
May be viewed upon application to ASHWELL AND NESBIT, LIMITED, Engineers, LEICESTER.

THE Knutsford Light and Water Com- pany invite TENDERS for their production of GAS TAR and AMMONIACAL LIQUOR for the Twelve Months ending July 31, 1900.
State Prices for Liquor of 5°, 5½°, 6°, 6½°, and 7° Twaddel.
The Company do not bind themselves to accept the lowest or any Tender.
Tenders to be sent in on or before the 8th of August, addressed to the Chairman.

BOROUGH OF HEYWOOD.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the purchase of about 50 Tons of SPENT OXIDE OF IRON.
Specification and Form of Tender and Sample may be obtained upon application to Mr. W. Whatmough, Gas Manager.
Sealed Tenders, endorsed "Spent Oxide," to be sent to me not later than Tuesday, Aug. 15, 1899.
By order,
J. H. BALDWICK,
Town Clerk.
Municipal Buildings, Heywood.
July 26, 1899.

LEIGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Gas Committee of the above Council invite TENDERS for the supply of GAS COAL and CANNEL for a period of Twelve Months.
Forms of Tender and further Particulars may be obtained on application to the Manager, Mr. John Foster, Gas-Works, Leigh.
Tenders to be sealed and delivered to me the undersigned on or before Twelve o'clock noon, on Wednesday, the 2nd day of August, 1899.
By order,
PEREGRINE THOMAS,
Clerk and Solicitor.
Town Hall, Leigh, Lancs.,
July 18, 1899.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.
He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.
Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

NITRATE of Thorium and Cerium.
FABRIK CHEMISCHER PRAEPARATE von STHAMER, NOACK, AND Co., HAMBURG.

ENRICH YOUR GAS
WITH CHEAP
BENZOL,
SPECIALLY PREPARED, FREE FROM SULPHUR.
AT to-day's Price of Benzol. Illuminating POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to SADLER & CO., MIDDLESBROUGH.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

Crown 4to., Price 3s. 6d.

GASHOLDER AND TANK

(Of One Million Cubic Feet Capacity)

AT THE

SUTTON GAS-WORKS.

Designed and carried out by

F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E.

MEMBER OF THE INSTITUTION OF GAS ENGINEERS,
MEMBER OF THE SOCIETY OF ARTS,
CONSULTING ENGINEER.

EMBRACING NOTES ON GASHOLDER CONSTRUCTION GENERALLY.

REPRINT OF A SERIES OF ARTICLES IN THE "JOURNAL OF GAS LIGHTING," &c., WITH THE ACCOMPANYING PLATES.

Other Works by the same Author.

The Guide-Framing of Gasholders, and Strains on other Structures in Gas-Works	6s. 0d.
Gasholders With or Without Guide-Framing: A Discussion; and Literature on Gasholder Construction	1s. 0d.
Flow of Gas, and Proportioning Gas-Mains	7s. 6d.

PUBLISHED BY
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON, NEWCASTLE."

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PATENT
CANDLE SAFETY LAMPS

Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

HOLMSIDE
GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	$16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality)	$13\frac{3}{4}$ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

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Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL CO., LD.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL CO., LD.
QUAYSIDE, NEWCASTLE-ON-TYNE.

G. & J. HAIGH,

Raven's Lodge Fire-Brick Works, DEWSBURY.

Manufacturers of MACHINE-MADE RETORTS and

FIRE-BRICKS of the highest Quality, made from Fire-Clay of a most Superior and Refractory Character suitable for **GLASS-WORKS, GAS-WORKS, and BLAST-FURNACES.**

For Prices and Analysis, apply as above.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

Midland and West of England District Office: 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.

London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.
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WORKMANSHIP and MATERIALS OF THE HIGHEST QUALITY.

PECKETT'S LOCOMOTIVES

Built to any Specification or Gauge.

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Complete Installations for Light or Power Erected.

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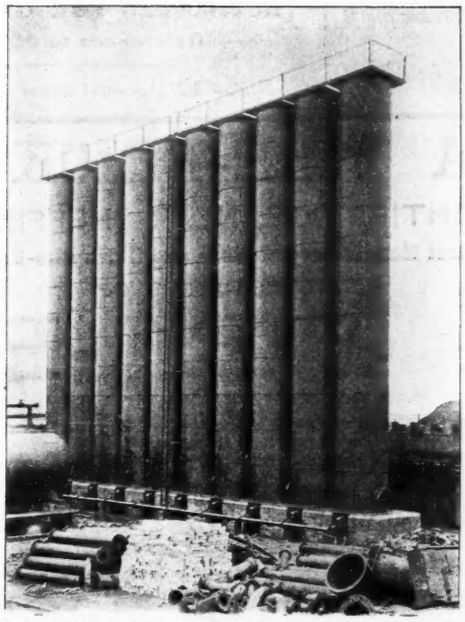

Set of Wrought-Iron Annular Condensers, with 24-inch Connections, 50 feet high, Outer Tubes 6 feet diameter, Inner Tubes 5 feet diameter.

CONDENSERS.
SULPHATE OF AMMONIA PLANTS.
RETORT-FITTINGS.
HYDRAULIC AND FOUL MAINS.
STEEL AND IRON PIPES.

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Gas and Electrical Engineers,

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Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

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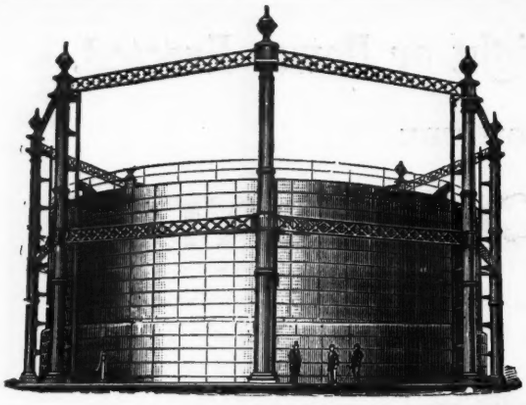

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GAS ENGINEERS,

MANUFACTURERS, IRONFOUNDERS, & CONTRACTORS,

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LINCOLN.

Telegraphic Address: "PORTER LINCOLN." National Telephone, No. 13.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

References to 600 Works already erected.

N.B.—All Communications to be addressed to the FIRM ONLY.

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Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.

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Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

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IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.

ORIGINAL MANUFACTURERS OF DRY METERS IN CAST-IRON CASES.

STATION METERS, EXPERIMENTAL METERS, PHOTOMETERS, & PRESSURE-GAUGES, &c.

Results of Tests of Dry Gas-Meters (Section III.) of the Glasgow Philosophical Society's Gas Exhibition, as per London "Gas Journal," May 10, 1881.

	ALDER & MACKAY.	W. & B. COWAN.	G. GLOVER & Co.	JAMES KEITH.	D. B. PEEBLES & Co.
Total of Fast Tests . .	47·2 ..	6·9 ..	33·6 ..	62·3 ..	53·7
Total of Slow Tests . .	25·3 ..	117·4 ..	43·1 ..	31·4 ..	38·5
	72·5 ..	124·3 ..	76·7 ..	93·7 ..	92·2

Descriptive Circulars, Price Lists, and Full Particulars forwarded on application.

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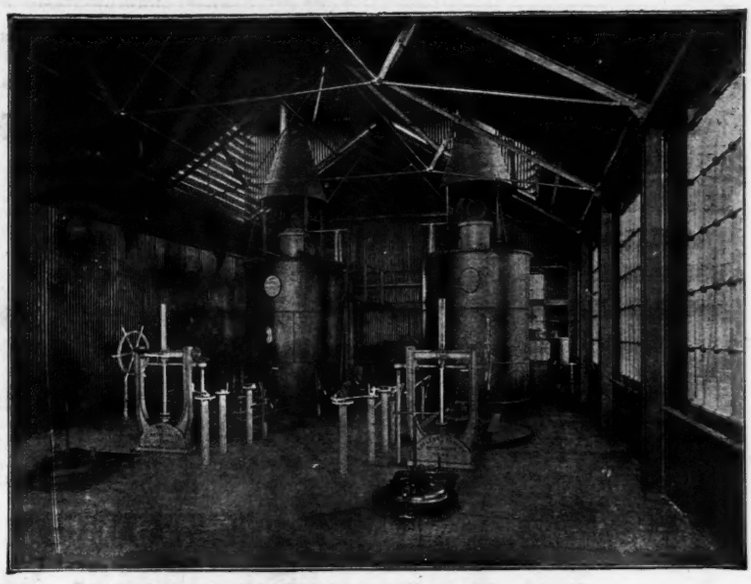
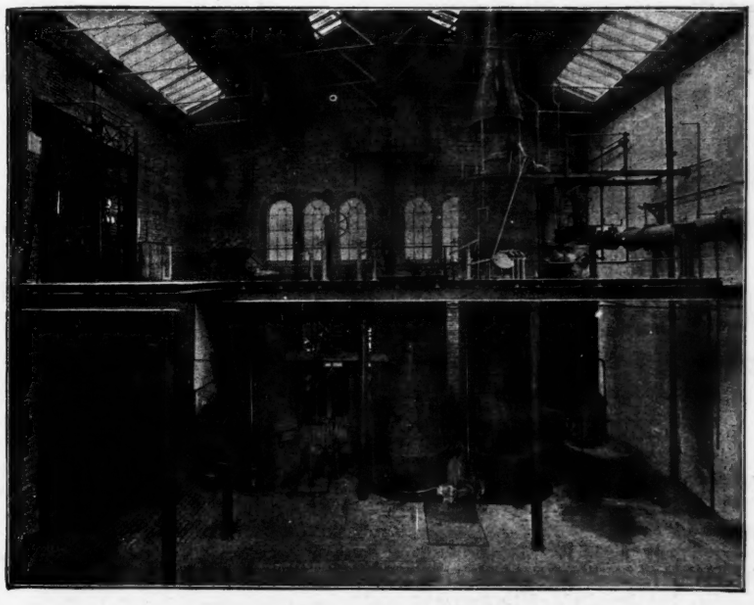
GASHOLDERS.

CARBURETTED WATER-GAS PLANT.



Water-Gas Plant at Southall.



Water-Gas Plant at Folkestone.

Carburetted Water-Gas Installations.

HORNSEY.
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SOUTHEND (2nd Order).
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EVERY DESCRIPTION OF GAS-WORKS APPARATUS.

Water-Gas Plant at Southend.

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UNDER CONSTRUCTION BY OUR OWN WORKMEN.

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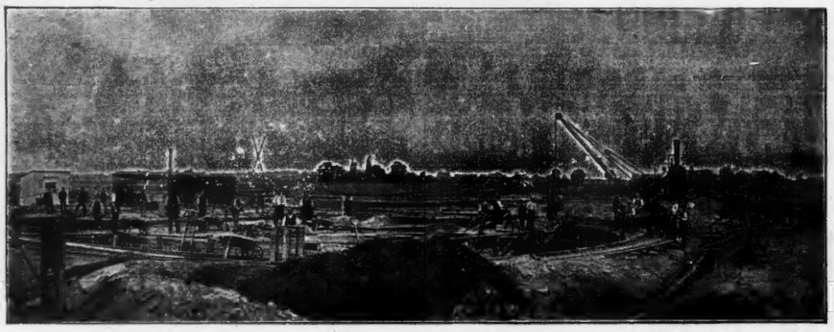

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J. & H. ROBUS, Engineering Contractors,
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For Carbonizing Advt. see last Issue.

H. KIRKHAM'S PATENT "IMPERIAL" WASHER-SCRUBBER.

TESTIMONIAL

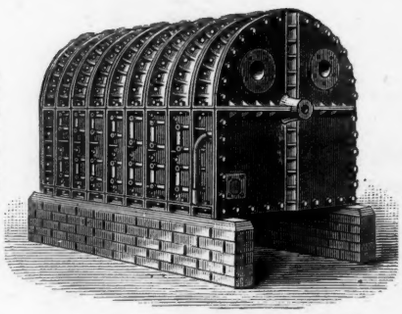
The Dover Gaslight Company,
Gas-Works, Buckland,
Dover, Feb. 8, 1899.

H. KIRKHAM, Esq.

Dear Sir,—Have now made further tests with the Washer fitted with your PATENT WASHING DEVICES, and have much pleasure in reporting that *the results were highly satisfactory*; also, I ascertained that the maximum results were obtained when the machine was working at three revolutions per minute. At this speed 13 to 14 gallons of water per ton of coal carbonized were converted into 10-oz. Ammoniacal Liquor, and at same time the Gas was free from Ammonia.

Should you wish further details, I will forward them.

I am, dear Sir, yours truly,
RAPHAEL HERRING, Engineer.



EFFICIENCY GUARANTEED.

Estimates given for a complete set of Segments for one wheel, or for refitting the whole number of wheels in a machine, also for Washer-Scrubbers complete.

The Scrubbing Devices are metal scrolls fixed in cages of segmental form, which can be readily and successively removed from the wheels through a manhole on the top or side of the machine, and the enclosed Scrubbing Devices taken out, cleaned, and replaced without the delay that necessarily takes place when the entire scrubbing material of the whole wheel has to be dealt with in one operation—thus effecting an important saving in time and labour. These Cages can be applied to the wheels of any machines of the type shown, and will increase their efficiency above 20 per cent.

The Scrubbing Devices are unequalled for extracting the whole of the Ammonia and a very large proportion of the Carbonic Acid and Sulphuretted Hydrogen from the Gas; and, if required, the strength of the Ammoniacal Liquor can be worked up to 30 oz. and above, which greatly reduces the quantity of Oxide or Lime, and also the amount of Labour for Purification.

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STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c, &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

London Agents:

BALE & HARDY, Gas Engineers and Contractors,
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WEST'S GAS IMPROVEMENT CO., LTD.

Gas and General Engineers,

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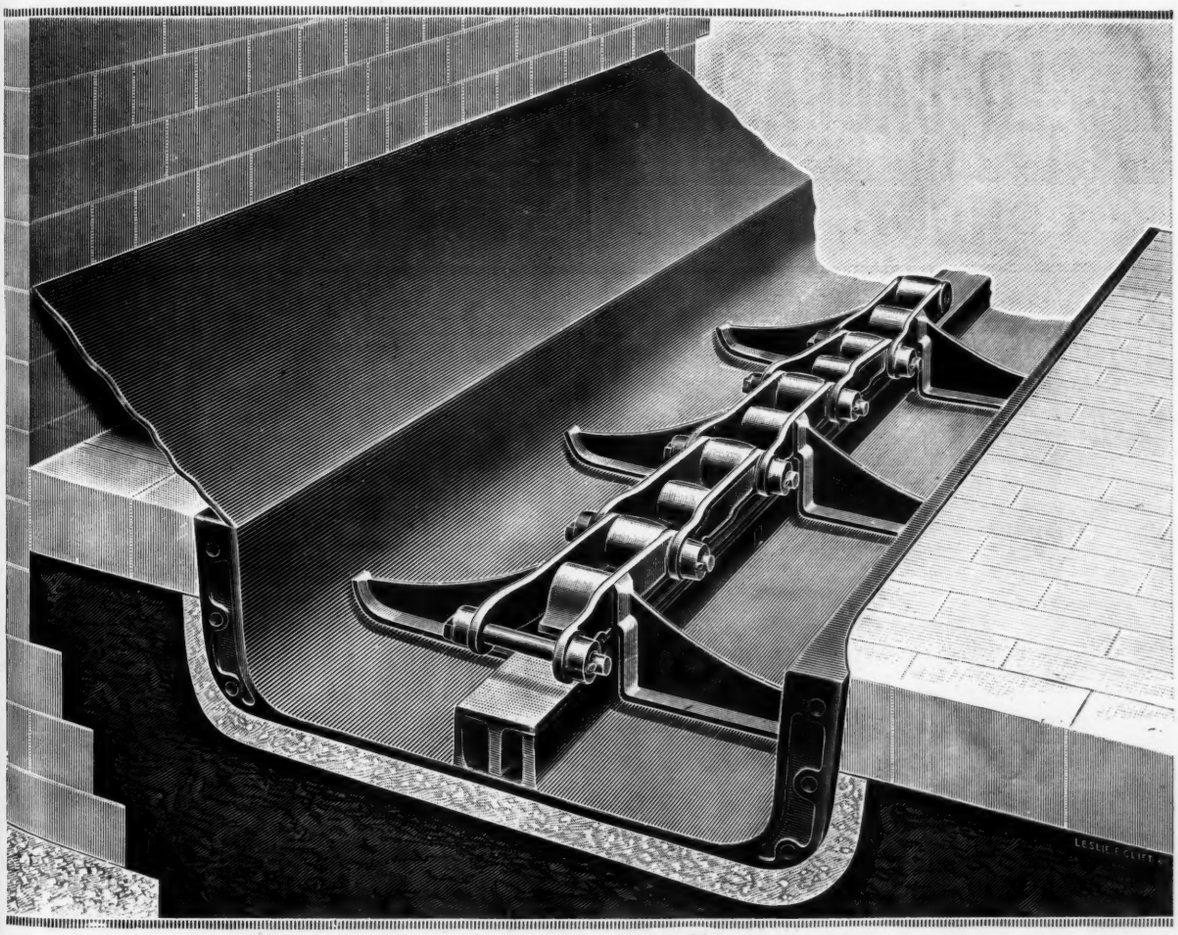

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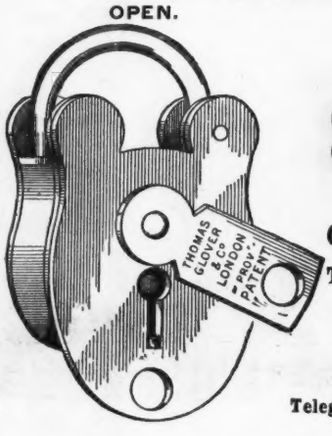

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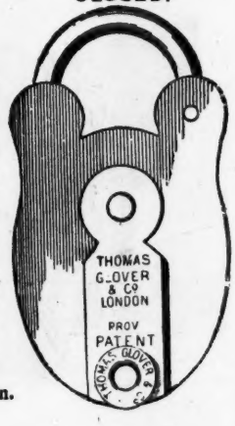

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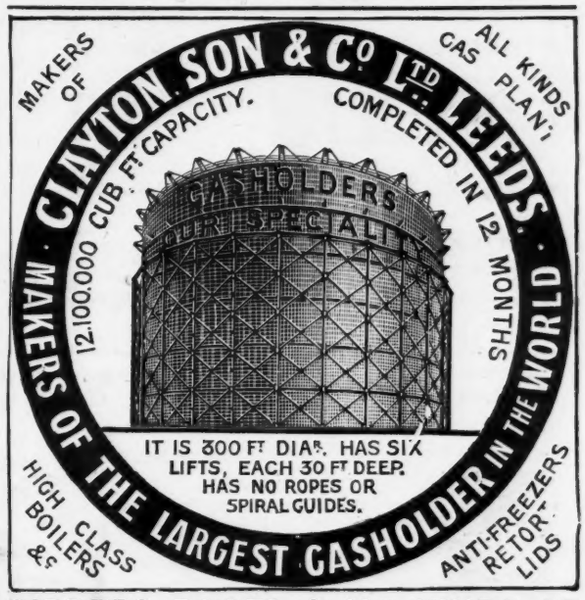
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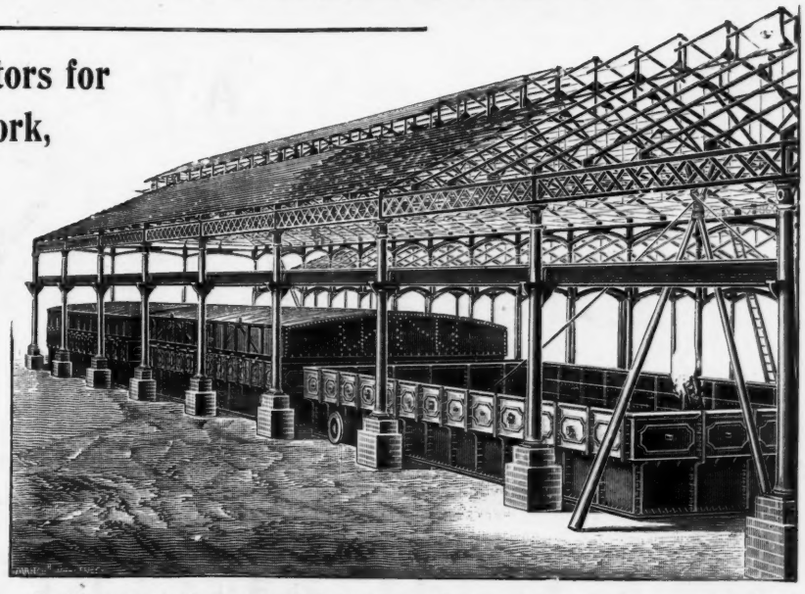

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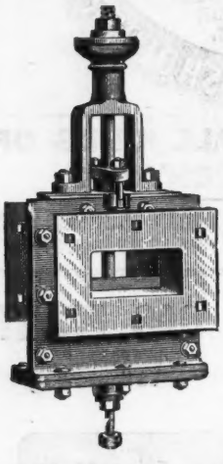

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